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ABSTRACT

The activities included in this publication were selected and developed to give teachers ideas and examples of ways to implement land use management instruction in the classroom. One of the primary objectives of this compilation is to demonstrate that there is now in existence a variety of materials that focus on land use concerns. The activities, designed for student use in grades K through 12, are "action-oriented" and involve student participation throughout the school community. Each activity has been classified by the authors according to the most appropriate grade level, subject matter and land use concept involved. In addition to being classified in these categories, each activity contains: (1) a statement of purpose on how the activity may be used; and (2) a reference to a source where the activity may be found in more detail or with variations. The subject areas encompassed by these activities include science, mathematics, social studies, language arts, and fine arts. Some typical activities are planting trees, examining soil, and discussing newspaper articles. (Author/BB)

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LAND USE MANAGEMENT ACTIVITIES

FOR THE CLASSROOM

Selected and Developed by

Mary Lynne Bowman
John F. Disinger

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and Environmental Education
College of Education
The Ohio State University
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June 1977

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ENVIRONMENTAL EDUCATION INFORMATION REPORTS

Environmental Education Information Reports are issued to analyze and summarize information related to the teaching and learning of environmental education. It is hoped that these reviews will provide information for personnel involved in development, ideas for teachers, and indications of trends in environmental education.

Your comments and suggestions for these publications are invited.

John F. Disinger
Associate Director
Environmental Education

Sponsored by the Educational Resources Information Center of the National Institute of Education and The Ohio State University.

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PREFACE

> "When we see land as a community to which we belong, we may begin to use it with love and respect. There is no other way for land to survive the impact of mechanized man, nor for us to reap from it the esthetic harvest it is capable, under science, of contributing to culture."
>
> -- Aldo Leopold

The activities included in this publication were selected and developed to give teachers ideas and examples of ways to implement land use management instruction in the classroom. One of the primary objectives of this compilation is to demonstrate that there are now in existence a variety of materials that focus on land use concerns.

The activities, designed for student use in grades K through 12, are "action-oriented" and involve student participation throughout the school community. Each activity has been classified by the authors according to the most appropriate grade level, subject matter and land use concept involved. In addition to being classified in these categories, each activity contains (1) a statement of purpose on how the activity may be used, and (2) a reference to a source where the activity may be found in more detail or with variations. (A complete list of all activity references plus additional resource materials including ERIC document numbers for those materials currently available through the ERIC system is found beginning on page 255.)

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It is hoped that the teachers who use these materials will recognize that the classified categories and statement of purpose serve only as a guide in selecting appropriate activities and should not be considered a fixed structure. In fact, it is recommended that teachers check for activities in the other grade level sections that may be appropriate for use or to adapt for use for their own particular set of learners.

Mary Lynne Bowman
John F. Disinger

BASIC CONCEPTS FOR LAND USE MANAGEMENT

Modified from Roth, Robert E., et al. Environmental Management Concepts—A List, Technical Report No. 126, Wisconsin Research and Development Center for Cognitive Learning, The University of Wisconsin, Madison, Wisconsin, April, 1970. ED 045 376.

1. Land use management to meet the needs of successive generations demands long-range planning since options available to future generations must not be foreclosed.
   p. 3, 8, 40, 66, 78, 95, 112, 156, 165

2. Maintaining, improving, and in some cases restoring soil productivity is important to the welfare of people.
   p. 6, 10, 20, 21, 39, 41, 44, 48, 86, 132

3. Increasing population and per capita use of resources have brought changed land to man or resource to population ratios.
   p. 85, 114, 128, 175

4. Social and technological changes alter the interrelationships, importance, and uses for land.
   p. 124, 154, 176

5. Multiple use is a practice in which a given land area functions in two or more compatible ways.
   p. 192, 194, 209

6. Zoning is a practice in which land uses are prescribed based upon value judgments regarding the needs of society.
   p. 97, 111, 123, 126, 177

7. Land use policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.
   p. 9, 24, 50, 56, 58, 61, 103, 113, 138, 158, 169, 182, 190, 210

8. Land use responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.
   p. 27, 49, 59, 105, 178, 180, 183, 188, 197, 199

9. We have "legal" ownership of some land resources like real estate and control over others during our lifetime, but ethically we are "stewards" rather than owners of the land.
p. 25, 80, 219

10. Natural resources are unequally distributed with respect to land areas and political boundaries thus, conflicts emerge between private land use rights and the maintenance of environmental quality for the general public.
p. 53, 55, 101, 104, 120, 228

11. Esthetic resources and recreational facilities of economic and non-economic value are becoming increasingly important in leisure-time activities.
p. 64, 84, 108, 119, 221

12. Physical characteristics of the natural environment are of major importance in determining land uses.
p. 15, 29, 33, 43, 67, 75, 91, 92, 127, 149, 160, 212

13. Man has developed techniques useful in describing land and its uses.
p. 13, 23, 26, 35, 37, 42, 62, 63, 76, 116, 130, 142, 152, 167, 186, 205, 224

CLASSIFICATION OF LAND USE MANAGEMENT ACTIVITIES

Grade Level:	K - 3	
	4 - 6	
	7 - 9	
	10 - 12	
Subject Area:	Science	including health, nature studies, home economics, etc.
	Mathematics	including arithmetic, geometry, industrial arts, etc.
	Social Studies	including geography, population, history, etc.
	Language Arts	including reading, creative writing, etc.
	Fine Arts	including music, art, theater, etc.

BREAKDOWN OF ACTIVITIES BY CATEGORY
(Some activities fall into more than one subject area.)

	Category	Number of Activities
Grade Level:	K - 3	15
	4 - 6	23
	7 - 9	32
	10 - 12	32
Subject Area:	Science	56
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LAND USE MANAGEMENT
ACTIVITIES
FOR THE CLASSROOM

Grades K-3

PURPOSE: To develop understanding of the importance of forests in our country and how to select and plant trees.

LEVEL: K-3

SUBJECT: Science

CONCEPT: Land use management to meet the needs of successive generations demands long-range planning since options available to future generations must not be foreclosed.

REFERENCE: Foster, Albert B. & Fox, Adrian C. Teaching Soil and Water Conservation: A Classroom and Field Guide. U.S. Department of Agriculture, Soil Conservation Service, August, 1970. ED 067 218.

ACTIVITY: Forests have played a big part in building and maintaining our cities, States, and Nation. As our young Nation grew, timber was needed in greater and greater quantities until much of the original woodlands were harvested.

We are now cutting about 7 percent more sawtimber than we are growing. About 22 percent more softwood sawtimber (Douglas fir, cedar, pine) is harvested annually than we are growing, mostly old growth in the West. Hardwood sawtimber growth exceeds removals by nearly one-third. But if all growing stock volume (cubic foot volume in trees 5 inches in diameter at breast height and larger) is considered, growth of both softwood and hardwood growing stock exceeds removals.

The Nation's timberland is owned by the forest industries; by county, State, and Federal governments; and by farmers, ranchers, businessmen, housewives, professional people, and many others. It is necessary that each owner see that trees are properly managed and replaced as they are harvested.

More than 245 million cords of pulpwood were required to meet all paper needs between 1964 and 1968 or an average of nearly 50 million cords a year.

Another function of the forest--one of the most important--is to protect watersheds. The headwaters of nearly all the major rivers lie in forests. Good management of these forests is one way of protecting the source of water.

Forests are homes for many kinds of wildlife--deer, bear, elk, beaver, squirrels. Small woodlands are natural homes for such fur bearers as the skunk, opossum, mink, raccoon, fox, and weasel.

One out of 3 acres of the entire United States is forest land. This totals about 762 million acres. Of this total 510 million acres is commercial forest land. Nearly 142 million acres of this is in various types of public ownership.

To keep such a large acreage in continuous production requires enormous planting operations. If left alone long enough most forests would replant themselves. But man cannot afford to wait and has, therefore, learned how to do the planting himself.

Spacing of the trees is important. A spacing of 6 by 6 feet requires 1,210 trees an acre. Closer spacing requires more trees. If planted too thick, the trees either must be thinned later or allowed to thin themselves through crowding and stunting. But closely spaced trees cover the ground more completely during the early years after planting and stop erosion sooner. In a thick stand, wider choice can be allowed in thinning; if some of the trees die the result is not so serious.

Foresters estimate that about 26 million acres of commercial forest land in the United States are nonstocked and need planting if they are to become productive within a reasonable time.

This activity is best suited to springtime in the North and to fall in the South. It may be made a part of an Arbor Day observance.

Plan in advance the kind of trees you are going to plant and where they will be planted. Soil and moisture conditions will determine to a great extent the kind of trees to plant. How the trees will be used will also have a bearing on the kind of trees selected.

Check with local specialists about the best time to plant and the kinds of trees best suited to the soil and location.

In addition to the seedlings or transplants, you will need buckets for carrying the seedlings, water, grub hoes or mattocks, spades, and shovels or specially constructed dibbles or planting bars. The size of planting stock will help determine planting method and tools needed.

If the area is covered with grass sod, use the grub hoe to strip the sod away from a spot 12 to 18 inches square. If the ground is hard, dig it up and crumble the clods.

Carry the seedling trees in a 12- to 14-quart pail half filled with water, or in boxes containing wet moss or burlap.

1. Take only one tree at a time from the container and leave the roots exposed no longer than necessary.

2. Set the tree in the hole no deeper than it grew in the nursery.

3. Do not put pieces of sod or undecomposed trash in the hole where it will be in contact with the roots.

4. Tamp the soil thoroughly around the roots; do not leave any air pockets.

5. Water thoroughly.

You will need to water the tree frequently if the ground is dry.

Also, the young trees will need cultivation one or more years in many sections of the country to eliminate grass and weed competition for moisture. A straw or grass mulch spread one to two feet around the tree will, in areas of high rainfall, eliminate or reduce the need for cultivation. For information on the best way to plant and care for trees in your area, see your county agent, extension forester, or soil conversation technician.

PURPOSE: To demonstrate the amount of sediment a stream carries.

LEVEL: K-3

SUBJECT: Science

CONCEPT: Maintaining, improving, and in some cases restoring soil productivity is important to the welfare of people.

REFERENCE: Foster, Albert B. & Fox, Adrian C. Teaching Soil and Water Conservation: A Classroom and Field Guide. U.S. Department of Agriculture, Soil Conservation Service, August, 1970. ED 067 218.

ACTIVITY: You will need three tall, narrow bottles, such as olive bottles, with tight stoppers for this experiment.

After a heavy rain, fill one of the bottles from a small stream that gets at least a part of its water from cultivated fields.

Then find one stream where all the water comes from woodland and one where the water comes from good pasture or meadow. Fill the other two bottles from these streams.

Allow all three of these samples to settle for a few days. Look at them daily and make notes on what you see.

There is an important story in these three bottles--the story of how sediment washed from farmland hurts the farmer and city dweller in many ways.

Sediment carried by streams hurts the farmer first because it is a part of his farm that is being carried away. Much of it is topsoil--the best soil he has. But a lot of it comes from gullies and roadside ditches, too.

After the sediment leaves the farm some of it gets into streams and begins to affect everyone. More than 3,200 water-supply reservoirs are losing water-storage capacity each year to sediment. Water bills are higher because the water must be filtered.

Seventeen percent of the electric power generated in the United States comes from hydroelectric plants. The storage reservoirs serving these plants are gradually filling with sediment.

Sediment fills road and railroad ditches, plugs culverts, and clogs stream channels so they must be cleared or the bridges raised. All this increases taxes.

Many harbors must be dredged annually to allow ships to enter.

Floods are more frequent and more serious, partly because the streams are choked with sediment, resulting in less capacity to carry floodwaters.

Silt harms fish by covering up their spawning grounds and shading out light. Many fish actually die during floods when their gills are clogged with silt.

Sediment is a national problem. The national sediment damage amounts to millions of dollars annually.

Soil and water conservation measures applied to farm and ranch land will greatly reduce sediment. Erosion that causes sediment deposition can be reduced up to 90 percent with soil- and water-conservation measures. Growing grass and trees will reduce erosion greatly. This is true because they give protective cover and add organic matter which helps the soil take in water more readily. Contour farming, contour stripcropping, and terracing also reduce erosion.

PURPOSE: To become aware of the importance of soil and participate in a soil conservation project.

LEVEL: K-3

SUBJECT: Science

CONCEPT: Land use management to meet the needs of successive generations demands long-range planning since options available to future generations must not be foreclosed.

REFERENCE: Conserving Our Natural Resources: A 4-H Readers Guide. Federal Extension Service, Forest Service, and Soil Conservation Service, U.S. Department of Agriculture.

ACTIVITY: Ask your students to think of ten things they use every day--- paper, pencil, shoes, etc. List on the chalkboard. Help the class determine how many items on this list come from the soil either directly or indirectly. They will find that most come from plants or from animals that feed on plants, and thus from the soil. Thus, it is important to employ conservation practices to conserve the soil. The following are suggestions for a soil conservation project that might be carried out by young children. Demonstration projects may be carried out on a lawn, in a community garden or on a vacant lot.

It may be possible to demonstrate several conservation practices on one plot. Terracing, cross-slope cultivation, grassed waterways, windbreaks of trees or tall-growing annuals, composting, mulching, fertilizing, grass seeding, and many other practices may fit into your class' plan.

For example: You can make a garden plan and use grass clippings, leaves and other vegetable or animal refuse to build up the soil's organic matter and make it more productive. You may choose to plant grass or other ground cover on bare spots to control soil erosion. Many eroded areas can be corrected by preventing excessive use and by planting grass and trees.

Wind and water erosion projects can also be carried out on sand dunes, highway roadsides, stream banks, ponds, and lakeshores.

PURPOSE: To identify land use practices utilized on your school grounds.

LEVEL: K-3

SUBJECT: Science

CONCEPT: Land use policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.

ACTIVITY: Take your class for a walk around your school grounds to observe and list (1) things man built and (2) things nature "built". Now ask the class what things man might have removed from the area in order to build. (Trees, grass, rocks, flowers, animal homes, other buildings.) What things may man have replaced? (Trees, grass, flowers.) Discuss reasons man wants and needs things nature built around him.

To demonstrate reasons man wants natural objects in his working/living environment ask the class to remember a hot day when they were playing in the sun. Where did they go outside when they wanted to cool down? (Under or near trees where there was shade.) If man cuts down all trees near buildings, how does this effect the environment in buildings both in summer and winter? (Trees can provide insulation from heat in summer and serve as windbreakers in winter.)

Compare grassy areas, bare soil and blacktopped areas. What are the advantages and disadvantages of each? For example grass is cooler, prettier and softer but can be destroyed in a heavy play area. Bare soil quickly becomes mud during a rainy season. Blacktop doesn't wear out as fast but is very hot in the sun and can be a hazard if you fall on it.

PURPOSE: To demonstrate how mulch prevents soil loss.

LEVEL: K-3

SUBJECT: Science

CONCEPT: Maintaining, improving, and in some cases restoring soil productivity is important to the welfare of people.

REFERENCE: Foster, Albert B. & Fox, Adrian C. Teaching Soil and Water Conservation: A Classroom and Field Guide. U.S. Department of Agriculture, Soil Conservation Service, August, 1970. ED 067 218.

MATERIALS: Two boxes about 16" long, 12" wide & 4" deep, two flower sprinklers, two half gallon fruit jars, two sticks of wood about 1" thick, plastic material, tin or tar paper and straw.

ACTIVITY: Water impact puddles the bare soil, clogging the surface pores. The result is that the soil cannot take in water. In a field, most of the water would run off rather than enter the soil.

By protecting the pores at the surface of the soil with a mulch, water enters and moves down through the soil.

A mulch, such as straw, grass, or shavings, prevents the puddling or "running together" of the surface soil under the impact of raindrops. Dead plant materials protect the soil from being detached by raindrops. As long as the soil is granulated water will soak in rapidly. However, water soon softens the binding material that holds the granules together, and then the granules and clods disintegrate. The impact of raindrops separates the fine particles, splashing them into the air. Then these particles accumulate on the soil surface and fill the spaces between larger particles and granules. The result is a "seal" over the surface that permits water to enter the soil very slowly, if at all. Water must then run off. If the land is sloping, it causes erosion during hard, beating rains.

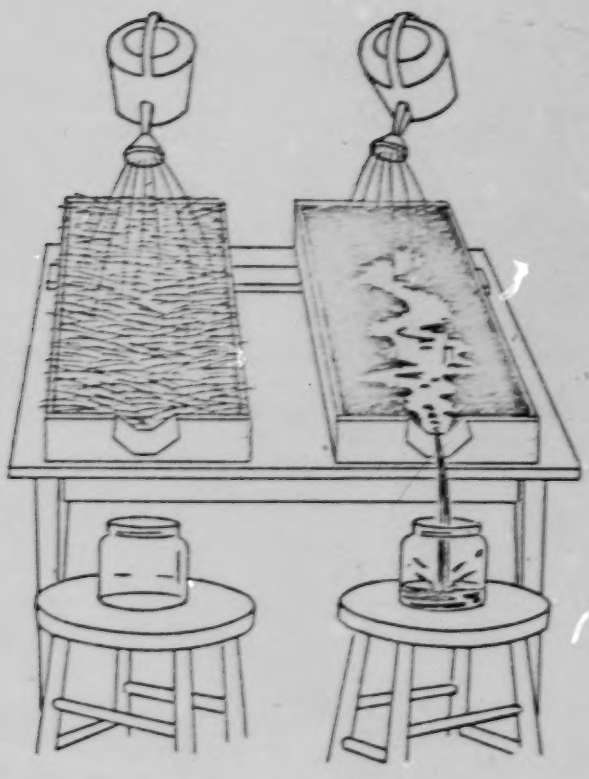
Mulches also reduce evaporation by shielding the soil from the wind and from the direct rays of the sun. In addition to mulches, high organic-matter content of the soil itself is needed.

Line the boxes with the plastic material, tin or tar paper to make them watertight. Fill both with the same kind of soil.

Set them on the table, placing the sticks under one end to make a slope.

Cover one box of soil with a thin layer of straw, grass, wood shavings, or sawdust; leave the other one bare. Sprinkle water on both boxes, using the same amount of water and pouring at the same rate from an equal height.

Note how much and how fast water runs off into each fruit jar.



Another way to study the protection of mulches on the soil is to drop water from a short height on soil that is not protected and on soil that is protected with a mulch.

For this you will need two small tin cans. With an 8-penny nail, punch a hole in the bottom of each can and fill the hole loosely with cotton.

Put one-half inch of soil in two small fruit jars or water glasses. Put a light layer of dry grass clippings on one of the soil samples. Leave the other one bare.

Arrange the tin cans so that they are about 4 feet above the jars of soil. Put about one-half inch of water in the cans. Large drops of water will form through the holes in the cans and drop on the soil in the jars. Note the amount of soil that is splashed on the sides of the glass.

PURPOSE: To observe the abilities of different kinds of soils to grow plants.

LEVEL: K-3

SUBJECT: Science

CONCEPT: Man has developed techniques useful in describing land and its uses.

REFERENCE: Exploring The World of Plants and Soils: Unit II-B; Soils. National 4-H Plant and Soil Science Program Development Committee.

MATERIALS: Peas, beans, corn or other seeds, four 5-quart oil cans, four kinds of soil as described in the activity.

ACTIVITY: Explain to your class that soils vary in their ability to grow plants. Desired soil qualities include anchorage for the roots, storage capacity for water and for nutrients and a porous condition so the roots can get air.

In this activity we are going to look at and try to explain differences in plant growth from the view of the plant's requirements.

Get four 5-quart oil cans or other suitable containers of equal size. The bottom 8 inches of a cut-off gallon milk carton is satisfactory as a container.

Punch several holes in the bottom of each with a large nail to allow drainage.

Label #1, #2, #3 and #4.

Fill #1 with surface soil from a field or garden.

Fill #2 with subsoil from the same area, taken from a depth below an observable change such as color, texture or structure.

Fill #3 with sand.

Fill #4 with a soil from the garden or a well fertilized area. (The garden soil should be typical of one that has had good treatment with fertilizer added.)

Be sure the soil in each container has been crumbled and broken up into small particles. Remove stones and trash.

Plant six peas, beans, corn or other seeds 1-1/2 inches deep in each container. Set containers in a warm, well-lighted place.

Keep moist and covered with a wet paper towel until the seed sprouts (germinates).

Observe any differences you see in the number of seeds germinating, and on the rates of plant growth and appearance.

Keep soil moist. Record the height of the plants in each container once a week for at least six weeks.

At the end of a six-week period there should be noticeable differences in plant growth among the containers.

Since moisture was ample in all cases, any inferior growth must be due to something else—deficiency of nutrients or air. Under equal watering, plants on sandy soils should suffer first because sand stores so little water. Dark soils, rich in organic matter, store much more.

A follow-up activity might be to walk with your class on a hot dry day and find a field with "patches" of wilted plants. Compare the soil in these spots with nearby soil where there is no wilting.

PURPOSE: To experience one type of land use management by processing maple syrup.

LEVEL: K-3

SUBJECT: Science

CONCEPT: Physical characteristics of the natural environment are of major importance in determining land uses.

REFERENCE: William F. Cowen, Jr., Extension Forester, The Ohio State University, Columbus, Ohio.

MATERIALS: Carpenter's brace with 7/16 or 3/8-inch bit, spile—metal collection spout—available at hardware stores or farm equipment stores, metal or plastic bucket (large tin cans or bleach bottles can be used), large pan and heat source for boiling down sap (the size or number of pans will depend on the amount of sap involved), thermometer with an easily read scale in the range of 200°F to 235°F (some candy thermometers are adequate), a piece of clean wool, orlon or other type material to use to filter the finished syrup while it is still hot, a few maple trees at least 10" in diameter.

ACTIVITY: Maple syrup production began with North American Indians who discovered the process of converting sap to syrup or sugar for use as a sweetener. Early Indian methods involved cutting a gash in the base of the tree, collecting the sap in bark or wood vessels, and boiling the sap to syrup by dropping heated stones into containers filled with sap.

Although there have been many changes in maple syrup production, the basic process of converting sap to syrup remains the same—evaporation of water to increase the sugar concentration in the remaining liquid.

The maple syrup industry in the United States averages about $12,000,000 a year. Rising sugar costs in recent years have created more interest in the "mini-production" of maple syrup since with a little inexpensive equipment and some maple trees available, people can enjoy a few quarts or gallons of high quality maple syrup.

"Sweet water" or sap can be obtained from sugar, black, red or silver maples.

Maple trees will produce sap at any time after the leaves drop off the trees in the fall. Good sap flows (called "runs") usually occur when a period of below-freezing weather is followed by periods of warm weather. Nights with below-freezing temperatures followed by a rapid-warming trend from early to mid-morning the next day will usually result in a good sap run.

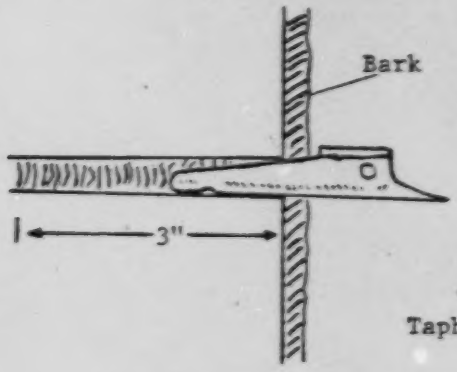
Stop collecting sap just prior to or at the very early stages of bud expansion and development in late March or early April —depending on weather conditions. Sap collected and processed into syrup when buds are expanding will result in "buddy" syrup, which has a distinctly unpleasant flavor.

Make tapholes by boring into the trees, using a carpenter's brace and a 3/8 or a 7/16-inch fastcutting wood bit. Bore the holes to a depth of 3 inches (not counting bark) into sound wood, from 2 to 5 feet above the ground. Slant the hole slightly to allow the sap to run out. On trees that have been tapped before, locate new tapholes 6 inches to one side and 4 inches higher than the old tapholes.

When possible, space tapholes evenly around the tree, with the number of tapholes depending on the diameter of the tree. Do not tap trees under 10 inches in diameter. Use one tap for 10-15 inch trees, two taps for 16-20 inch trees, three taps for 21-25 inch trees, and no more than four taps on trees over 25 inches in diameter.

If weather conditions are right, sap may start to flow as soon as you bore the tapholes. Do not leave chips or wood shavings in the tapholes.

When sap begins to flow from the hole, you will need a device to convey the sap from the taphole to a sap container. In commercial production, such devices are called "spiles" or "spouts". Some hardware and farm equipment stores have these for sale.



Taphole with spile.

Spouts usually have a tapered shoulder which forms a watertight seal with the bark and outer sapwood, when they are driven into position in the taphole. The part of the spout inside the sealed area is more heavily tapered so that there is free space left within the taphole between the spout and the

sapwood. This allows sap to move from the wood into the taphole and from there though the hole in the spout and out over the lip of the spout, from there it drops into a bucket, plastic bag or other receiving equipment.

In the early days, hollow reeds were used as spouts. Another type of spout used was hollowed-out wooden dowels that were slightly larger in diameter than the tapholes and were beveled at the point of taphole seating.

The amount of sap flowing from a taphole is highly variable during the season and usually varies with weather conditions. In most years, a single taphole will produce from a quart to 2 gallons of sap per run, with seasonal production of 10 to 15 gallons. Sap production per taphole varies over a wide range and may be as low as 5 gallons or as much as 40 gallons in a season.

Collect sap and boil it down as quickly as possible to produce good-tasting syrup. Collect sap often. Buckets should have covers to keep out rain and other foreign materials.

Good sanitation and rapid handling of the sap from tree through evaporation and packaging is extremely important in producing good quality syrup. Bacteria and other microorganisms can build up in sap that is kept in buckets or storage tanks for more than a few hours when the air temperature is warm.

Keep buckets, storage tanks and/or other collecting and processing equipment thoroughly washed between runs. Washing with a solution made of 1 part commercial liquid bleach (5.25% solidum hypoclorite by weight) and 9 parts of water will usually maintain collecting vessels in clean condition.

Woodland-type sugar maples produce sweet water that averages around 2% sugar content. The problem is to remove enough water to get a sugar concentration of about 66%. Actual sap-sugar concentration varies widely from tree to tree. For example you would need 43 gallons of sap with a 2% sugar concentration to produce 1 gallon of finished syrup, containing 65.5% sugar.

Maple producers use a rule-of-thumb in estimating total syrup production over a season, based on the number of tapholes, and usually figure 1 gallon of finished syrup (65.5% sugar concentration) for every 4 tapholes.

You can concentrate sap to syrup by boiling it in an open pan. For boiling at home, it is important to have a device for removing the water vapor to some point outside the home, or do the actual boiling outside. The boiling process produces large quantities of steam that may damage wallpaper and/or painted surfaces.

The evaporating container may be a large open pan filled with sap and exposed to heat. As boiling begins, foaming may occur. You may need a pan with fairly high sides so that the sap does not boil or foam over the sides.

During the boiling process, be careful not to burn or scorch the sap. Liquid levels deep enough to prevent scorching must be maintained over the pan bottom. A teflon coated pan is highly acceptable. If much foaming occurs, skim off the foam or reduce foaming by using a commercial defoaming preparation. Some producers have used small amounts of cream or butter for defoaming, even though these two substances may, in some cases, impart a slight off-flavor to the syrup.

The key to high quality syrup is cleanliness and rapid boiling. As boiling begins and water evaporates, add more sap to the pan. Continue this process until a suitable amount of concentrated sap is left in the pan. Concentrating the "batch" to an acceptable density is a process called "finishing off."

Finished syrup of acceptable density will boil at 7 1/4°F. above the boiling point of water. It should be noted that the boiling point of water varies with elevation above sea level, and with barometric pressure. Therefore, you must determine the boiling point of water before adding the 7 1/4 degrees as a basis for the boiling point of finished syrup. Knowing this boiling point is a must for good syrup.

Some candy thermometers are suitable for measuring the temperature of the boiling liquid. Any thermometer used should have an easily read scale with a temperature range to at least 15 degrees above the boiling point of water. A thermometer with a temperature range of 200°F. to 235°F. will cover most situations.

As the temperature of the boiling liquid approaches the syrup finishing point, take extreme care to prevent the boiling process from burning, scorching or overheating the liquid.

Once the syrup has reached the desired boiling point, it is ready for filtering and packaging. Filter the hot syrup through clean filters of wood or orlon. The filtering process helps to remove sugar sand and other suspended particles, and improves the appearance of the syrup. After filtering the hot syrup, package it in tightly sealed, clean containers. Syrup temperature should be at least 180°F. at the time of packaging to assure good keeping qualities.

Although processing methods in this activity are intended to help persons who want to produce small quantities of maple syrup for home use, but not for sale, weight standards applying to

producers who sell syrup may be of interest to you. The net weights for standard-density syrup, exclusive of container weight, are 1 gallon (231 cubic inches) weighs 11 pounds, 1 quart weighs 2 pounds and 12 ounces; 1 pint weighs 1 pound and 6 ounces. Syrup having the standard density of 11 pounds per gallon contains 65.5% solids as sugar.

PURPOSE: To develop understandings of the capabilities of local soils.

LEVEL: K-3

SUBJECT: Science

CONCEPT: Maintaining, improving, and in some cases restoring soil productivity is important to the welfare of people.

REFERENCE: A Handbook of Environmental Encounters, Oregon Department of Education, Instruction Division, pp. 23-24. ED 113 151.

ACTIVITY: A primary, though not the only, factor in determining capability of land (i.e., what its potential uses are) is the type of soil present. Any study of land use, therefore, appropriately includes a consideration of its soils, what they are, and how they are properly utilized.

1. COMPARISON OF SOIL COLORS

Take students on a walk around the school yard or a nearby field or woodland and collect soil samples. Look for soil colors. If variations cannot be found, have students bring soil samples to class to compare with those taken on the walk. Discuss factors that influence color of soil.

2. COMPARISON OF SOIL TEXTURE

Take the class outside to the school soil bank—or a place where soil is observable. Have each student take a handful of soil and work it in his hand. Discuss the feel or texture. (Encourage use of good descriptive words.) Then moisten samples. Does this change the feel? Does it stick together? Is it like sand? Is it like clay? Discuss the particles. What are they like? Would the soil soak up water or let it run through? Would it be good for a garden?

3. OBSERVATION OF PLANT GROWTH AND DECAY

On a walk around the school ground name or "touch and describe" all the growing plants. Sit down and talk about what conditions plants need in order to grow. Elicit the understanding that plants get nutrients and water from the soil. Walk to an area where there is decaying material such as a rotten log or rotting leaves. Ask what is happening here. Are these things alive? Where do they go as they decay? Do they change the soil?

On a cardboard, have the students draw a picture showing the cycle of plant growth and decay.

PURPOSE: To show how contour farming can help prevent erosion.

LEVEL: K-3

SUBJECT: Science

CONCEPT: Maintaining, improving, and in some cases restoring soil productivity is important to the welfare of people.

REFERENCE: Foster, Albert B. & Fox Adrian C. Teaching Soil and Water Conservation: A Classroom and Field Guide. U.S. Department of Agriculture, Soil Conservation Service, August, 1970. ED 067 218.

MATERIALS: Two boxes about 16 inches long, 12" wide & 4" deep or two round dishpans, two sprinklers, two fruit jars, plastic material, tin or tar paper.

ACTIVITY: Contour farming is one of the easiest and most widely accepted conservation practices. It is the use of implements across the slope of the land; that is, on the contour. When a farmer farms on the contour he disregards the usual straight field boundaries and straight-rows and follows curved lines whenever necessary to stay on the contour.

Contour farming should be used in combination with crop rotations, grass waterways, fertilizers, and returning organic matter to the soil. Contouring alone will not stop erosion. But it reduces soil erosion as much as 50 percent on a wide range of soil and slope conditions. Steepness and length of slope are important, as well as the crop grown and the condition of the soil.

There are other advantages of contour farming. In low-rainfall areas it helps hold and conserve rainfall. Farmers have found that it saves power, time, and wear on machinery because the equipment is working at peak efficiency all the time instead of being overloaded going uphill and under-loaded coming downhill.

Cultivation on the contour helps prevent erosion and saves rainfall in gardens on sloping land.

Fill both boxes with soil taken from the same place. Make them watertight by lining them with plastic material, tin or tar paper.

Set them on a table and place the sticks under the end to make a slope. Place fruit jars below the spouts of the boxes. Using your finger or a pencil, make furrows across the soil in one box and up and down the soil in the other.

Fill two sprinklers with water and slowly sprinkle the two boxes at the same time. Hold the sprinklers the same height above the soil and pour at the same rate. Compare the rate of flow into the two jars and note the difference in their contents.

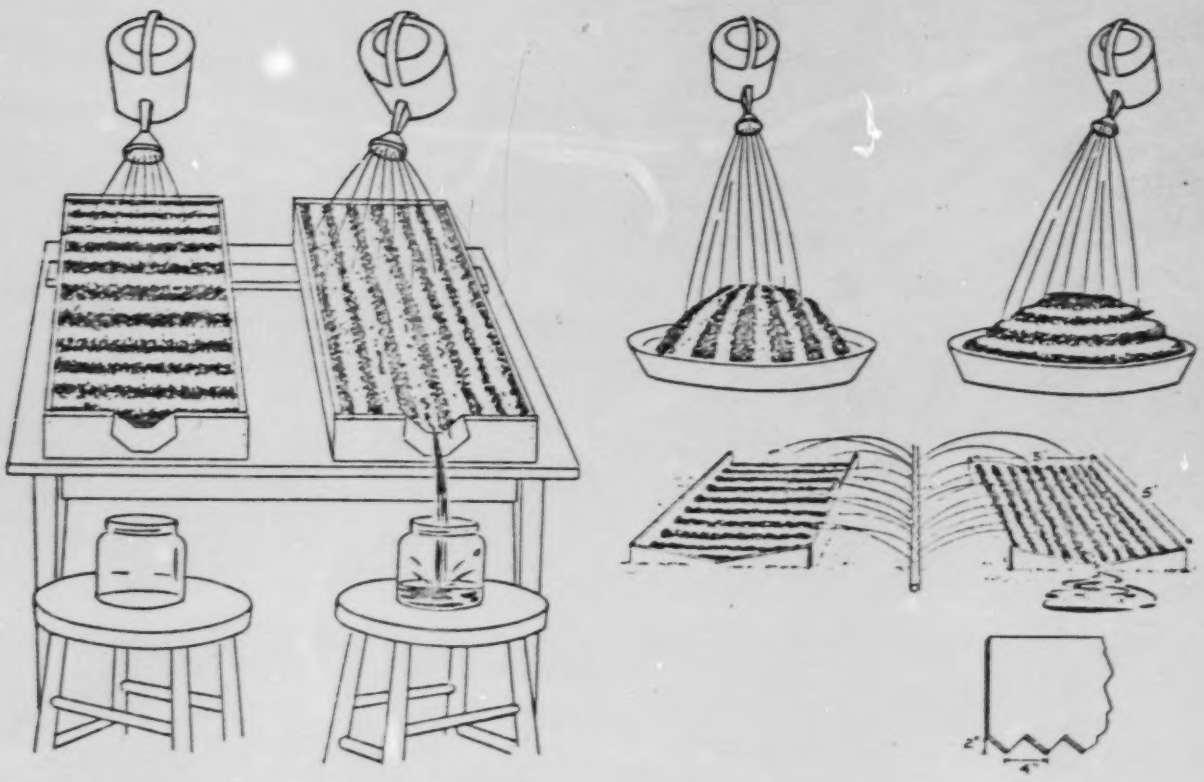
Another way to do this is to put mounds of soil in the middle of the boxes or in two large round low dishpans. With a pencil or your finger make furrows up and down one of the mounds and circles around the other mound. Sprinkle an equal amount of water on each mound and observe the water. Remember though, that such mounds probably have much steeper slopes than most cultivated land.

You can do this in the yard if you have a sloping area where there is no grass or where the grass is badly worn by walking or playing. By doing this outdoors, you can use a larger area. Make two plots 3 feet wide and 5 feet long with 1 or 2 feet between them.

With a regular garden hoe cut grooves 4 inches apart and about 2 inches deep across the slope on one plot and up and down the slope on the other. Notches cut in the edge of a 1- by 12-inch board (as shown in the drawing) can make the grooves.

Lay a perforated lawn-sprinkling hose between the two plots and turn it on so that a steady shower falls on both plots with equal intensity.

Make careful notes of what happens on both plots.



PURPOSE: To survey school land use problems and suggest corrective measures.

LEVEL: K-3

SUBJECT: Science
Social Studies

CONCEPT: Man has developed techniques useful in describing land and its uses.

REFERENCE: Roller, Lib. Using the School and Community: An Environmental Study Area. Nashville Metro Schools, Nashville, Tennessee, 1972. Title III, ESEA. ED 071 917.

ACTIVITY: Divide your class into groups of four or five students. Give each group the following list of problems that you might have on your school site. Instruct each group to check any they see; then as a group try to figure out how they might correct the problem. Compare lists and suggestions among groups and try the suggestions to see if the problems are improved.

School Site Problems	What To Do
____ low wet places	_____
____ soil erosion	_____
____ no grass cover	_____
____ overflowing trash	_____
____ cracked sidewalks	_____
____ holes in street	_____
____ broken street lights	_____
____ peeling paint	_____
____ old odors	_____
____ car or bike ruts	_____
____ gravel getting on grass	_____
____ broken windows	_____
____ no trees	_____
____ others	_____

PURPOSE: To experience considerations such as those that land use managers have in planning.

LEVEL: K-3

SUBJECT: Social Studies

CONCEPT: Land use policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.

REFERENCE: Stehney, Virginia A. Environmental Curiosity Sampler. Illinois Institute for Environmental Quality, Chicago, Open hands Project, Nov. 1974. ED 103 339.

ACTIVITY: The classroom is an important environment where students and teachers spend a great deal of time. With your students try to plan a better way to arrange the classroom and then try out your plan. The following questions may be appropriate to begin this activity:

1. Would a different physical set-up of our room be better?

2. Are books, materials, science equipment and supplies easily accessible?

3. Could the room be better arranged for small group work?

Now survey the class and make a list on the chalkboard of the most important; i.e. most valued arrangements you and your class need. Also list things you do not like and wish changed. Divide into groups and have each group plan and sketch possible room arrangements that include the "most important list." (You may find that in order to get one thing the group wants, another might have to be given up.) As a group, select a plan and try it out. Note: a good plan should reflect the values and priorities of the group and allow for change if something does not work out as expected.

Point out to your class that people who plan neighborhoods, housing developments, farms, etc. go through a process similar to the one you and your class did. Choices must be made to pick out the most important things that can work in the available space.

PURPOSE: To demonstrate that people must share space (land) in order to do many of the things they need to do or want to do.

LEVEL: K-3

SUBJECT: Social Studies

CONCEPT: We have "legal" ownership of some land resources like real estate and control over others during our lifetime, but ethically we are "stewards" rather than owners of the land.

REFERENCE: Clark, Richard C. (Project Director). Environmental Values Action Cards, Minnesota Department of Education, 1976.

MATERIALS: Several jump ropes

ACTIVITY: Give several students a jump rope. Either in the gym or outside, instruct the students to use the jump ropes to make the boundaries of an individual room for themselves. Now, ask them to try to jump, run, hop, twist, sit, tumble, skip.....in their rope room space. Could they each live in their room? Now allow them to join their room with someone else's by tying the ropes together or overlapping them. Repeat the activities; i.e. jump, run, etc.

When the rooms are shared can they do more or fewer of the activities? When the rooms are shared do they have to do anything differently then when they each had their own room? Do you need rules? Who should make the rules?

PURPOSE: To identify types of land use described in well known songs.

LEVEL: K-3

SUBJECT: Fine Arts
Social Studies

CONCEPT: Man has developed techniques useful in describing land and its uses.

ACTIVITY: Discuss the meanings of the following type of land use: open land, residential, commercial, agricultural, industrial, recreational and transportation. Take the first verse of the song "America The Beautiful" and identify the various types of land use described. You may wish to point out on a map of the United States the area described in the song, and have the class do a mural with land use types identified.

Think of other well known songs that mention types of land use such as:

"This Land Is Your Land"
"Home on the Range"
"Oats, Peas, Beans and Barley Grow"
"Country Roads"
"I've Been Working On the Railroad"
"Dixie"
"Don't Fence Me In"

PURPOSE: To participate in a problem-solving land use management project involving playground improvement.

LEVEL: K - 3

SUBJECT: Fine Arts
Social Studies
Language Arts

CONCEPT: Land use responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: Bennett, Dean B. & Willink, Wesley H. Grade Three Environmental Education Teacher's Guide: The Neighborhood. Yarmouth Maine School Department, 1975. Title III, E.S.E.A. (Activity by Pat Driscoll) ED 121 568.

ACTIVITY: With your class, take a walk around the play area noting number of improvement areas in terms of recreation.

Have students make a mural of their play area before improvement.

Have the children bring in magazines and cut out pictures of playgrounds or things they would like to see on their playground, i.e., tires, culverts, balance beam, painting board, all types of gym equipment, swings, climbing equipment.

Using the pictures, make a mural of the "Perfect Playground." (A trip to other school sites may help them to realize different ways to solve their problems. If there has been an improvement recently at a certain school site, a speaker could relate the solution to the children.)

Discuss how your class might campaign for their "perfect playground". What actions are necessary such as finding out what new equipment would cost, what permission is needed, how long it would take to make the improvements, how hard it would be, etc.?

Use the following list as a guide:

1. Survey the student body as to use, likes and dislikes, suggestions for improvement.

2. Decide whether or not a new plan should be adopted or additions should be made to the original plan.

3. Vote: balloting, campaigning, speeches. Poster contests, etc.

4. Get permission

5. Bring in materials

6. Divide into groups

7. Set time schedule

8. Delegate duties

9. Promote other student body members to help in monitoring

10. With the necessary help, have the equipment placed in pre-planned spots and have old equipment moved as needed

11. Discuss success

PURPOSE: To investigate types of vegetation that are appropriate to plant around buildings and become aware of reasons for these choices.

LEVEL: K-3

SUBJECT: Science
Math
Art

CONCEPT: Physical characteristics of the natural environment are of major importance in determining land use.

ACTIVITY: Take your class for a walk around the school building and with permission from the owners around a few of the lawns of homes nearby. With a meter stick/yard stick measure the heights of plants growing within three feet of the buildings. Are they tall plants? Are there many big trees? What would happen if large trees were planted right next to a building? Are there different types of plants growing on the north side of the building than are growing on the south side? If so, why? Now look for examples of plantings that are poor choices; such as, trees planted too near the sidewalk, flowers planted in an area that is heavily walked on, trees planted under wires, flowers requiring a lot a sunlight planted in shady areas. What are the bad effects of these poor choices? Why do people plant ground cover such as bluegrass instead of flowers in their lawn?

Upon your return to the classroom, ask your students to draw a picture of their dream home and "plant" good choices of vegetation in their yards. Have each student share his/her picture with the rest of the class and point out where and why he/she placed certain types of plants in his/her yard.

LAND USE MANAGEMENT
ACTIVITIES
FOR THE CLASSROOM

Grades 4-6

PURPOSE: To describe the value of vacant lots in providing plants and animal habitats.

LEVEL: 4-6

SUBJECT: Science

CONCEPT: Physical characteristics of the natural environment are of major importance in determining land use.

REFERENCE: Project Learning Tree Supplementary Curriculum Guide for Kindergarten Through Grade 6. Copyright 1977 by American Forest Institute. Reprinted with permission of AFI.

ACTIVITY: Locate a vacant lot and get permission from the owner for your students to conduct a study project there. Divide your class into teams of three to five students each and have each team stake out a plot 12 feet (4 meters) square.

Ask each team to examine its plot for signs of animal life, such as burrows, tracks, anthills, and spider webs. Suggest that they also inventory the kinds of plant life they find. Using the data collected, ask each team to draw a map which indicates locations of plants and animals (or their signs) on its plot. Later, these maps could be combined to create a map of the vacant lot.

During the period of time the students are observing and inventorying their plots, suggest that they:

1. Find evidence of use by some animals that don't live there.

2. Find evidence of some animals preying on others.

3. "Prove" that certain plants grow better in certain locations.

4. Find evidence that certain animals stay in the vicinity of certain plants.

5. "Prove" that there have been changes in the plant and animal populations from previous times, including changes in their numbers and ratios to each other.

Working in small groups or individually, ask the students to prepare presentations to illustrate the value of vacant lots in providing plant and animal habitats. Their presentations might take the form of guided tours for younger students; oral reports to adults in the community, complete with their plant and animal maps; or even recommendations to city officials for care of vacant lots in the community.

EXTENSION: For more extended study of vacant lots, see "Vacant L[illegible] Studies" in the National Wildlife Federation's Environmental Discovery Units.

PURPOSE: To observe how rain drops wash the soil.

LEVEL: 4-6

SUBJECT: Science

CONCEPT: Man has developed techniques useful in describing land and its uses.

REFERENCE: Exploring the World of Plants and Soils: Unit II-B; Soils. National 4-H Plant and Soil Science Program Development Committee.

MATERIALS: Two white stakes, sprinkler can or hose, box or step ladder, 50 cent piece.

ACTIVITY: In those places where the soil was deposited again as alluvial or bottomland and wind-laid soils, we often find the richest land. There are two lessons here:

1. erosion robs us of the best elements of soil;

2. there is no predicting exactly when or where it will be laid down again.

Erosion is caused in large measure by disturbance of the natural landscape. Raindrops falling on unprotected soil loosen the particles which are then carried away by running water. Erosion occurs in three forms--sheet, rill and gully.

Sheet erosion is a more or less uniform removal of soil as in sheets, by water or wind. No obvious channels develop. It is perhaps the least noticeable form in the early stages.

Rill erosion results from development of small channels. It ranks in importance between sheet and gully erosion. The numerous channels usually are brushed over by normal field operations.

Gully erosion is the most conspicuous form of water erosion. It can be spectacular but is destructive and cancerous to the land. Gullies grow with the concentration of runoff.

Soil Erosion is Important

Erosion is a selective process by which the finer and more fertile soil elements are lost first. The surface soil is generally the richest part of the soil. Eroded soils are not only less productive, they are more difficult to work.

Generally, erosion is more serious on land with shallow surface soils and unfavorable subsoils. Much of the sloping

cultivated land in the United States has been affected by sheet erosion. Gully erosion has taken its toll, particularly on steep areas frequently cultivated and lacking vegetative cover.

1. Drive a white stake 3 inches wide into bare soil (no vegetation) deep enough to stand. Lay a 50 cent piece near the stake.

2. Drive a second white stake in a good sod or lawn.

3. Fill a sprinkler can with water or use a hose with a nozzle set to sprinkle.

4. Place a box or step ladder near one of the stakes.

5. Stand on the box or step ladder and sprinkle around the first stake. Let the water fall from the can or hose to the ground.

6. Repeat steps 4 and 5 at the other stake.

7. Observe splashing of soil on the white stakes. Particularly watch for any effect of the 50 cent piece on the washing of the soil. Discuss reasons for any differences between the sod and the bare soil.

Expand on this activity by taking the class to visit a bare field after a rain. Note how small rocks were left suspended. Also look for places where running water has deposited the soil removed from upslope.

PURPOSE: To test the ability of surface soil and subsoil to hold water that might be usable to plants later.

LEVEL: 4-6

SUBJECT: Science

CONCEPT: Man has developed techniques useful in describing land and its uses.

REFERENCE: Exploring the World of Plants and Soils: Unit II-B; Soils. National 4-H Plant and Soil Science Program Development Committee.

MATERIALS: Two flat heat resistant pans, two empty pint jars, two funnels, two pts. of water.

ACTIVITY:

1. Select a soil from a pasture or fence row.
2. Collect a quart of soil from the surface soil* (relatively coarse layer). Label this "Surface Soil". Collect a quart of subsoil* (the finer textured layer, usually 12 to 24 inches deep). Label this "subsoil."

   *NOTE: If you are going to do Exercise 7 and 8 also, you should get three quarts of surface soil and three quarts of "subsoil." Be sure to label them.
3. Get two flat, heat resistant pans. Label one "surface soil" and the other, "subsoil."
4. Spread surface soil and subsoil thinly and evenly in the pans as labeled.
5. Place both pans of soil in an oven at 200° F. for 24 hours or place them in the sun for several days.
6. Stir soil occasionally, to ensure thorough drying.
7. Place small pieces of cheese cloth over the spout of two funnels. Hold the cheese cloth in place with rubber bands.
8. Place the funnels in empty pint jars.
9. Gently fill one funnel with surface soil to 1/2 inch from the top. Do not crush the soil.
10. Place the pan of surface soil behind this jar.

11. Repeat steps 9 and 10 using subsoil, rather than surface soil.

12. Fill two pint jars with water.

13. Gently and slowly pour all of the water from a full pint jar over the surface soil sample. Let the water run through the funnel into the jar beneath.

14. In the same way, pour water from the other full pint jar over the subsoil sample.

15. Now, note which jar has the most water?

16. Therefore, which soil held the most water?

Explain why one soil held more water than the other. If you were growing plants in these two soils, which one would be able to hold the more rain water for later use by the plants?

Subsoil _____

Surface Soil _____

_____

PURPOSE: To learn techniques to keep an area suffering from erosion from eroding further.

LEVEL: 4-6

SUBJECT: Science

CONCEPT: Maintaining, improving, and in some cases restoring soil productivity is important to the welfare of people.

REFERENCE: Fox, Charles E. Conservation Activities For Young People. Forest Service, U.S. Department of Agriculture, March, 1969. SE 010 359.

ACTIVITY: Locate a gully near the school. What caused it? Find out from technical advisors (soil technicians, county agents, foresters) how to keep it from increasing in size. (By building check dams, by sowing grass, and by planting shrubs and small trees.) Let the pupils do the necessary work. Drive stakes to mark present limits of the gully and observe over a period of a year or longer to see what is happening. Keep class record.

PURPOSE: To study the effects of grazing in woodlands.

LEVEL: 4-6

SUBJECT: Science

CONCEPT: Land use management to meet the needs of successive generations' demands long-range planning since options available to future generations must not be foreclosed.

REFERENCE: Fox, Charles E. Conservation Activities for Young People. Forest Service, U.S. Department of Agriculture, March 1969. SE 010 359.

ACTIVITY: Visit woods that have been grazed. Look for absence of young seedlings, browsing damage of leaves and twigs, injury to soil and roots by trampling, start of erosion caused by trailing of stock to salt or water, bare and hard-packed ground. Dig down and note depth of topsoil. Compare this with depth in cultivated field and in an ungrazed woods.

What is effect of grazing this woodland? Now? Ultimately?

PURPOSE: To investigate a land use practice; i.e., a large pasture or natural range used by domestic livestock.

LEVEL: 4-6

SUBJECT: Science

CONCEPT: Maintaining, improving, and in some cases restoring soil productivity is important to the welfare of people.

REFERENCE: Fox, Charles F. Conservation Activities for Young People. Forest Service, U.S. Department of Agriculture, March, 1969. SE 010 359.

ACTIVITY: Visit a large pasture or natural range used by domestic livestock.

1. How many head of stock are run, and what is the season of use?
2. What kinds of plants are growing?
3. Which species appear to be normally grazed? Which grazed too heavily? Which are ungrazed?
4. Are there sizable areas of bared ground?
5. Are there any gullies, broken sod, grazed trees or shrubs, plants on "pedestals," accumulations of washed soil at the base of plants?
6. Is there evidence of rodents? What damage do they do? Are they being controlled? How?
7. Dig down and note depth of topsoil. Compare with topsoil depth in a hayfield and in an ungrazed woods.
8. Do you think the pasture is being used properly? What would increase production of forage?

PURPOSE: To investigate how organic matter affects soil.

LEVEL: 4-6

SUBJECT: Science

CONCEPT: Man has developed techniques useful in describing land and its uses.

REFERENCE: Exploring the World of Plants & Soils: Unit II B, Soils. National 4-H Plant & Soil Science Program Development Committee.

MATERIALS: Water, quart of clay, quart of saw dust, 2 paper plates.

ACTIVITY: As a group, collect a quart of clay soil and a quart of sawdust. Label a paper plate "sawdust" and another "no sawdust." Moisten 1 cup of soil until it will make a mud cake. (If the soil does not hold together, get a soil with more clay.)

Place the mud cake on the plate labeled "no sawdust."

Moisten and mix thoroughly 1/2 cup of soil and 1/4 cup of sawdust until they make a mud cake.

Place the mud cake on the plate labeled "sawdust."

Place both plates in the sun and let the mud cakes dry.

When they are completely dry, break the mud cakes with your hands. Which cake crumbled easier? Why? Which soil do you think would be more likely to erode? Now compare the soil on the bare school play yard with the soil along a fence or wall that is covered with grass. How could you improve the physical condition of the bare soil?

Cultivating a soil affects it somewhat like opening the draft on a furnace. More heat is given off but more fuel (nutrients and organic matter) must be added to keep the fire alive.

Loss of organic matter causes clay soils to become tighter and more cloddy. They soak up rain less readily and thus more water runs off. This leads to increased erosion. Sandy soils become less firm with the loss of organic matter; they are removed more easily by wind or water.

It is important to get as much organic material into the soil as practical each year. Upon decomposing it aids in preserving good physical conditions of the soil and supplies some nutrients.

List things a farmer could do if he wished to improve his crop yield. Example: return crop residue and manure to soil.

PURPOSE: To illustrate that differing soil types support different types of plant growth.

LEVEL: 4-6

SUBJECT: Science

CONCEPT: Physical characteristics of the natural environment are of major importance in determining land use.

REFERENCE: A Handbook of Environmental Encounters. Oregon Department of Education, Instruction Division, p. 24. ED 113 151.

ACTIVITY: The teacher suggests, "Let's build a small world of our own. What do you think we'll need to make this world?" (Students suggest soil, plants, animals, water, air.)

Equip the class with trowels, buckets, plastic bags and take them out to collect materials for their terrarium. They should find gravel or sand, charcoal, wood soil containing humus, small plants and tree seedlings, mosses, ferns, lichens, and an interesting rock or two.

Assemble the terrarium, having the students decide what should be put in first (1 or 2 inches of gravel or sand—to store the excess water). What should come next? (Charcoal—to keep the soil from getting sour.) Then add the soil 3 or 4 inches deep. Plant the small plants, covering the remaining soil with moss.

Sink a small container or saucer into the soil. Put water in the dish and also sprinkle the plants. Place rocks in position and cover the container with glass cover or plastic secured with a large rubber band.

Have students find animals after the terrarium has been assembled. Suggest they look for such creatures as snails, grasshoppers, frogs, lizards, beetles, and caterpillars.

Observe from day to day:

1. The growth of the plants.
2. "Rain" in the terrarium.
3. Animals eating.

Have the students bring from home some containers (glass candy dishes or wide-mouthed peanut butter jars) and make their own terraria. Set them up with different types of soil (sandy, clayey, silty). Let them find as many of their materials as possible. Review procedures for assembling the terrarium, which may be the desert, semiarid, or "rainy" type. Use large jars, plastic bags, or whatever is available. Whether the terrarium flourishes or not, it should provide a good learning situation.

PURPOSE: To undertake a conservation project to slow down erosion.

LEVEL: 4-6

SUBJECT: Science

CONCEPT: Maintaining, improving, and in some cases restoring soil productivity is important to the welfare of people.

REFERENCE: Roller, Lib. Using the School and Community: An Environmental Study Area, Nashville Metro Schools, Nashville, Tenn., 1972, Title III, ESEA. ED 071 917.

ACTIVITY: Take an "Erosion walk" around the school neighborhood. Watch for bare soil, exposed tree roots, gullies, holes, etc. Try to find out what might have caused the erosion. What can be done about them? If they are not fixed what might happen in the future?

If there are erosion areas on the school site a conservation project can be done by the students.

The following are some suggestions for erosion projects:

Wattling:

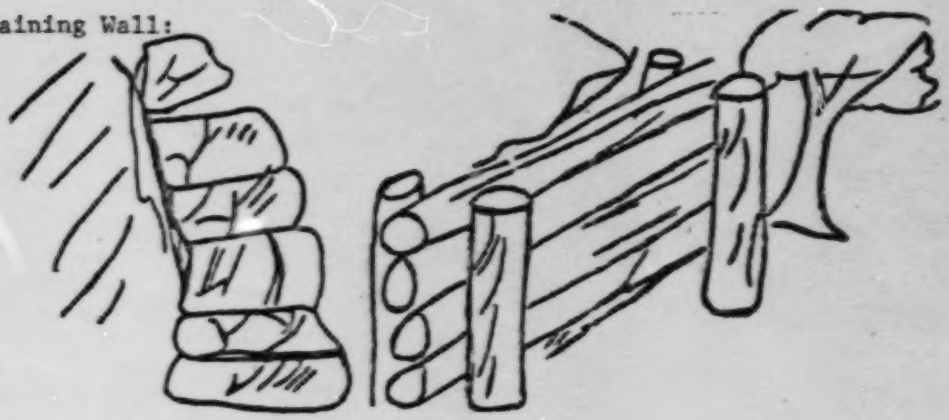
Type of Project: building rip-rap to hold back or slow down eroding hillsides.

Implications:

a. Keeps hillside from washing or blowing away.
b. Often times it provides area for planting trees, brush, or grasses.
c. Usually last long enough for plants, etc., to get a good enough start to hold back the soil on their own.
d. Beautifies site.
e. Protects hillside trails.
f. Can prevent undermining of building foundations.
g. Allows the water to seep into soil instead of running off.
h. May prevent the rolling of rocks.

Cautions:
a. Start wattling at top of slope.
b. Use long, flexible twigs.
c. Drive stakes as deep as possible.
d. Do not put stakes too far apart.
e. Do not remove any vegetation or other natural obstacles already there.
f. Avoid wattling in areas where there is a danger to human safety, i.e., across trails and so forth.
g. Do not allow wattling to run down from lack of repair.
h. Allow wattling to remain until the soil is stable enough to support itself, i.e., when young trees, grasses and the like have established themselves.
i. Do not attempt wattling on too steep a slope.

Retaining Wall:



Type of Project: Designed to slow down erosion on hillsides. May be made either with rocks or logs. Very practical where eroding area is too steep to wattle. May be one wall or a series of small ones.

Implications: (Same as for Wattling)

Cautions:
a. Avoid soft, decomposing rocks and logs.
b. Do not start base with small rocks or logs.
c. Do not build too high and lose stability.
d. Select rocks and logs easily managed by boys and girls.
e. Watch to see that, as work proceeds, the rocks are not becoming too small preventing height planned.
f. Avoid "stacking." Rocks and logs must be fitted.
g. Be sure base is broad enough to support height planned.
h. Be sure wall has a slight slope toward hillside for added strength.

Retaining Wall (I): ROCK

A rock retaining wall can be constructed with a minimum of tools. A simple rock retaining wall can be built without the use of cement. Large rocks are to be used at the base with size decreasing as they near the top. Small rocks or stones can be used as wedges or plugs behind the wall. The base rocks should be sunk about four to eight inches into the soil at the base of the wall

Retaining Wall (II): TERRACED ROCK

Stairway-like arrangement on a hill or slope. Same type of construction as in the larger rock retaining walls. These walls are only built to a height of about three to four feet.

Retaining Wall (III): LOG

This type of log construction can be made by setting four logs upright, two at each end, leaving a space between them where other logs can be set in horizontally to the desired height of the wall.

On this type of wall, end logs should be set with one end buried in the embankment. The retaining logs should be set alternately between these logs and the spaces between should be plugged with large rocks.

Gully Control:

Type of project: The pilling of brush in deep gullies (rock also may be used dam style.)

Implications:

a. Brush piles slow down erosion.
b. Brush provides shelter for wildlife.
c. Catches soil behind each pile.
d. After gully is almost filled, trees, plants or grasses that are adaptable to the area may be planted.
e. Decomposing vegetation adds to topsoil.
f. Supplies an area for disposal of bramble.
g. Prevents the rain from making direct contact with the soil.
h. Slows water, allowing for better seepage.

Cautions:

a. Do not use materials that will combust spontaneously.
b. Do not allow it to become a "trap" to people walking in the area.
c. Sharp objects should not point upward.
d. Do not use good material for fill-in that can be better used elsewhere for other projects.

Gully Control (I)

Start at the top of the gully and fill with brush or rock. Gully may also be filled with soil and planted.

Gully Control (II)

Where gullies are large, where slope of land is ideal, and where a large amount of water passes each year, a water pond of this type may serve for fishing, as a watering pond for wildlife or livestock, and/or the surrounding area may be planted to provide shelter and furnish food for wildlife.

PURPOSE: To determine how different soil types are related to plant growth.

LEVEL: 4-6

SUBJECT: Science

CONCEPT: Maintaining, improving, and in some cases restoring soil productivity is important to the welfare of people.

REFERENCE: A Handbook of Environmental Encounters. Oregon Department of Education, Instruction Division, p. 29. ED 113 151.

ACTIVITY:

1. COLLECTING SOIL SAMPLES:

Walk around the school grounds or its vicinity and observe the types of plants growing in the area. Determine the kinds of soils that three different varieties of plants are growing in.

By observation learn how the soils differ and how they are alike. Are they sandy, silty or clayey? Base your judgment on color and texture.

2. DESCRIPTION OF SOIL:

If the three kinds of soil texture cannot be located around the school area, have students bring samples of each to class and describe the texture and colors which they believe are best for growing different kinds of plants.

3. GROWING SEEDS IN DIFFERENT SOILS:

Have the students plant three bean seeds in three types of soil. Before planting, soak the seeds overnight in water. Water the plants for three weeks with an identical amount of water, and see that they obtain the same amount of sunlight. Observe changes (if any) daily at a given time and record them on a student-designed chart.

4. SUMMARIZING OBSERVATIONS:

After observing and recording the growth of the plants, have the students record in written form what they learned about soil texture. Which soil holds water best? Which soil produced the best growing plant? Why? Which soil would be best for garden use? How should the soils be used in order to make the best use of the land?

Using the information on the three types of soil, describe what could be done to increase its potential. If possible, a field trip should be arranged to a nearby farm to see if land is being utilized to its fullest potential.

PURPOSE: To encourage students to share in the responsibility of caring for public property.

LEVEL: 4-6

SUBJECT: Social Studies

CONCEPT: Land use responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: Kohuth, Barbara J. and Marsh, Boyd T. An Educational Guide for Planning an Improved Human Environment. Inner Circle Press, Inc. Hudson, OH, 1974. SE 022 539.

ACTIVITY: Begin by asking your class the following:

1. Why waste land on parks and playgrounds? Who maintains and pays for them?

2. If adults don't use playgrounds why should they pay for them?

Point out to the class that care of public properties is the responsibility of the public and that the "public" includes all people including youth. Thus, it is every student's responsibility to care for public property.

Now, ask how students might help do their part.

Select a park or playground site near the school. Explore ways that students might beautify and/or maintain "their site". For example: students may survey their site to see if there are enough litter containers. If more are needed, obtain oil drums from area service stations. Clean and paint the drums with ecologial messages. Use as litter baskets.

PURPOSE: To develop understandings of land use practices in urban areas and in the school community.

LEVEL: 4-6

SUBJECT: Social Studies

CONCEPT: Land use policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.

REFERENCE: Roller, Lib. Using the School and Community: An Environmental Study Area, Nashville Metro Schools, Nashville, Tenn., 1972. Title III, ESEA. ED 071 917.

ACTIVITY: Land use and waste pollution go hand-in-hand but the idea of land use goes beyond that of pollution problems. It strikes at the everyday increase in building, in taking up farm and wilderness land for other purposes and the sprawl and blight of the urban communities. Some discussion and ideas were included in Section III under Vacant Lot Studies but this section of the handbook will include suggestions for conservation projects as well as questions and discussions on the role of land in the environmental pollution cycle. It is important that the students understand that one type of environmental pollution invariably leads to another.

About three-fourths of all the people in our country now live in urban areas. Each urban area must provide the people living there with stores providing many services and goods. There must be places for entertainment and cultural areas. There must be jobs for the people and industry to furnish materials and supplies.

Along with the many benefits of living in an urban area there are also many problems. Land becomes very valuable and therefore, there is a shortage of parks and open spaces.

One of the most difficult problems is the fact that most urban areas have grown without much thought about how it should be built. Unplanned development can cost more for the people living there and the people can also experience many inconveniences and hazards. This is often called urban sprawl. Traffic congestion, old buildings not repaired and all of the resulting pollution problems are merely part of this problem. As the city grows the land pollution causes include erosion, indiscriminate clearing, removal, filing in, mining, drilling and paving of land. The effects of this can be seen in unsightliness, loss of valuable top soil for food production, the destruction of wildlife habitats in field, forest and marsh, the extinction or near extinction of hundreds of species and in the city, a growing concern for better planning for all living things.

Many areas today are in Urban Renewal areas. If the school is located in such an area, a valuable lesson for the children would be to study the pro and con issues of such projects. Too often our students live in areas that have many problems but they are not aware of what can be done or what they and their families can do to change many of the problems.

Questions for discussion:

Many cities have museums, theatres and other cultural centers. What advantage would they serve for people? (Recreation)

How is money obtained to build and maintain such places? (Taxes, grants, admission charge.)

Is it fair for all people to pay taxes for this type of recreation? What other recreation might appeal to other people that are built or maintained this way? (Racetracks, Amusement parks, Community parks.)

How would the city benefit, money wise? (Tourists)

There are several kinds of living places in a city. Apartments and private houses are two types. What are the advantages of each? (Apartment—no worry about yards, more people around, usually more convenient) - Small house (more privacy, more room to play, less noise.)

Which type is considered better for cities? (Apartments—take up less room, live near jobs, newer.)

What happens as parts of the city grow old? (Crowded, dirty, waste in the streets, crime increases.)

What happens to a city that grows old? (People try to move out, industry moves away, empty buildings.)

What does Urban Renewal try to do? (Replace unsafe structures with new buildings, repair better structures, clean up area.)

What are some of the problems in this? (No place for people living there to go, no services left in area, unused land that may become a hazard.)

Make a survey of the school community. See how many types of services are within walking distances of the school. Find vacant lots nearby. Check the "zones" of the area around the school. Is the property being taken care of? Is there open land? If so, what use might it be put to in the future? If the community needs services, what would be the most needed one? Make a list back in the classroom.

See how natural land and water features have influenced the growth of the city. See what has happened in the school community that has affected it. What man-made things have changed the community? (Highways, bridges, etc.)

What things did you discover that you didn't know were in the community? Where were the traffic signals? Were there other places they were needed? What services for children were there in the community? For adults? What services were needed that were not there? Which should be put in first? Were there enough parks and play areas? If not, where could some be placed? Were there places to get food? Clothes? Hardware? Gas? If not, where was the nearest place? If there were no nearby stores and someone did not have a car, how would he get these needed items? Are there factories in the neighborhood? Is it creating a hazard for the people living there? Smell? Smoke? Other dangers? Are the houses old or new? Are there any apartments? From this the children can make a land use survey and a future plan for land use.

PURPOSE: To understand conflicts in land use priorities.

LEVEL: 4-6

SUBJECT: Social Studies

CONCEPT: Natural resources are unequally distributed with respect to land areas and political boundaries thus, conflicts emerge between private land use rights and the maintenance of environmental quality for the general public.

REFERENCE: Project Learning Tree. Supplementary Curriculum Guide for Kindergarten Through Grade 6. Copyright 1977 by American Forest Institute. Reprinted with permission of AFI.

ACTIVITY: Choose a piece of forested land with which your students are familiar and which is located near your community. Present this hypothetical situation: The community has acquired this land because the owner has not paid the property taxes. The city council is uncertain whether to keep or sell the land. If council members decide to sell the land, they must also decide to whom it should be sold.

Depending on the size of your class, ask each individual student or group of students to assume one of a variety of possible roles:

Housing development contractor
Realtor
Wood products industry representative or tree farmer
Recreation director
Energy firm representative
Mining firm representative
Cattle rancher
Conservation group representative
Private business person
Industry representative
Golf course manager
Homeowner
Land speculator
Grain farmer
Government representative for city, state and federal levels

The exercise is often of most value to students if they can develop their own list. In any case, ask them to suggest additions to the list and select from any of those suggested.

Ask each individual or group to research the part they choose by interviewing a counterpart in the community. Assist the students in the preparation of their interview questions.

Once the research is completed, each could prepare a written document stating the reasons the land should become his or hers. Points to consider in developing the position statements are:

The price each interest group is willing to pay.
For each interest group, the social, aesthetic, psychological, and ecological advantages of acquiring the land.
The long-range effects of each use on the land's productivity.
The economic advantages of each land use to the community.
Are these advantages short-run or long-term?

When all the statements are ready, ask each student or group to make an oral presentation before a mock city council of four to six students. The council, after hearing and considering all the testimony, should decide whether the land will be sold and if so to whom and at what price. Afterward, the class can question the council on the reasons for its decision. A general discussion by all class members should then be held to consider the implications of such a decision, and possible implications of those actions not taken.

PURPOSE: To illustrate a societal conflict relating to land use management.

LEVEL: 4-6

SUBJECT: Social Studies

CONCEPT: Natural resources are unequally distributed with respect to land areas and political boundaries thus, conflicts emerge between private land use rights and the maintenance of environmental quality for the general public.

ACTIVITY: Pose the following situation to your class: Mr. A and Mr. B are neighbors. Mr. A is unemployed due to a physical handicap. He does, however, earn income from keeping several bee-hives and producing honey. Mr. B and his family are sensitive to mosquito bites. Their city will provide fogging services during the mosquito season for those citizens requesting the service. However, fogging kills Mr. A's bees as well as Mr. B's mosquitos. Thus, if the area is fogged, Mr. A loses his income; if it is not Mr. B's family may be bitten by mosquitos. Who has the right to make the fogging decision in this situation? After a class discussion, check with local authorities to determine how this problem would be handled in your community.

PURPOSE: To learn how group decisions affecting private citizens and free public are made.

LEVEL: 4-6

SUBJECT: Social Studies

CONCEPT: Land use policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.

REFERENCE: Project Learning Tree. Supplementary Curriculum Guide for Kindergarten Through Grade 6. Copyright 1977 by American Forest Institute. Reprinted with permission of AFI.

ACTIVITY: Prepare a scenario describing a hypothetical situation for distribution to students:

There are 50 summer cabins on Lincoln National Forest land along Bear Creek. The sites for these cabins were leased to private citizens 30 years ago. At that time there was very little forest recreation in this area.

Since then, the nearest city has grown tenfold. Recreation in the Bear Creek area is almost 20 times what it was 30 years ago.

Some people feel that those 50 cabins should no longer be permitted to dominate that area of Bear Creek and that the land belongs to all of the people.

Should 50 families have Bear Creek to themselves or should their leases be terminated and the cabins removed? Should the cabin owners be allowed to remove the cabins? Should they be reimbursed for their value?

Divide the class into these three groups:

1. Three or four members to represent the Forest Service Advisory Board. They will conduct a hearing and arrive at a decision.

2. Half of the remainder of the class will role-play the cabin owners.

3. The other half of the remaining students will represent the general public.

Allow the "cabin owners" and "general public" time to prepare testimony stating their reasons for either renewing the leases or abolishing them. During this period the U.S. Forest Service Advisory Board should plan the hearing procedures, specifying who testifies, for how long, and in what order.

When all groups feel they are ready, the hearing should be convened. After the testimony has been presented and opportunity for rebuttal provided, the Advisory Board should meet briefly to reach a decision. They should then return and report their decision to the entire class, explaining the reasons for their decision.

Following this simulation, discuss with the students the means by which such land-use decisions are made in your local region.

Note: It is useful to have the classroom arranged as a hearing room for the meeting or to find an available auditorium.

PURPOSE: To describe the effects of industry locating in a town.

LEVEL: 4-6

SUBJECT: Social Studies

CONCEPT: Land use policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.

REFERENCE: All Around You: An Environmental Study Guide. U.S. Department of the Interior, Bureau of Land Management, 1971. ED 064 131.

ACTIVITY: One of the main reasons for people moving to the cities in this century has been the location of jobs. People in the city depend upon their job for an income which will buy food produced in the rural area as well as other goods services. Both good and bad effects result from an industry locating in a town. Jobs are created and income flows in the town, but negative effects can also occur.

What is the main industry (or industries) in your town?

About how many people in town depend on this industry for their living?

How might the climate affect the types of industries located in your town and their operations?

Think of the effects (both good and bad) that this industry has on:

land	animals	people
air	water	you
	the town	

Give some examples:

	Good	Bad
land		
air		
animals		
town		
people		
you		

PURPOSE: To demonstrate that people in a community can either manage their environment and improve their neighborhood or let it decay.

LEVEL: 4-6

SUBJECT: Social Studies

CONCEPT: Land use responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: Kohuth, Barbara J. and Marsh, Boyd T. An Educational Guide for Planning An Improved Human Environment. Inner Circle Press, Inc., Hudson, Ohio, 1974. SE 022 539.

ACTIVITY: Set the stage for this activity by discussing various neighborhoods in the school locale. Ascertain why one area may be much better cared for than another. (For example: A merchant anxious to attract and please customers might enhance his property whereas an industrial area may be apathetic to the grounds around the buildings.) List positive resident attitudes.

In an effort to prompt your students to exert control over their environment by improving conditions, form a "Class Committee Yard Survey and Spruce Up Organization." Divide class into committees of four. Each group of four arranges to survey the yard conditions of each committee member. (You may wish to notify parents of this activity and solicit their cooperation.) Use the following survey sheet to record observations:

COMMITTEE YARD SURVEY

Inspect the yard closely. Discuss your observations with the rest of the committee.

	Yes	No
1. Is there evidence of litter, papers, tin cans, etc. in the yard?	___	___
2. Is there rubbish (wood, tires, old appliances, etc.) in the yard?	___	___
3. Are the garbage cans tightly covered?	___	___
4. Are there sufficient garbage cans?	___	___

	Yes	No
5. Is there evidence of rats, raccoons, or stray dogs?	___	___
If "yes", where do they hide? _____		
_____		
Can they get into the house?	___	___
Where?_____		
6. Are there:		
-broken basement windows	___	___
-holes in the foundation	___	___
-doors not tight-fitting	___	___
7. Are any environmental improvements needed?	___	___
If "yes", what do you suggest?		
_____		
_____		
_____		

Discuss survey results and "Spruce-Up" ideas for students and parents to jointly work on.

After two weeks, the committees should re-survey each yard. Hopefully, an improvement in conditions will be noted.

"Before" and "After" photographs might graphically tell a story in terms of environmental action or inaction.

PURPOSE: To discuss land use conditions home builders/buyers should consider.

LEVEL: 4-6

SUBJECT: Social Studies
Science

CONCEPT: Land use policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.

REFERENCE: Kohuth, Barbara J. and Marsh, Boyd T. An Educational Guide For Planning An Improved Human Environment. Hudson, Ohio: Inner Circle Press, Inc., 1974. SE 022-539.

ACTIVITY: Ask your students to pretend they are real estate agents trying to sell the same exact new house under each of the following conditions:

- in a suburban housing development
- in an industrial area of town
- next to a nuclear power plant
- in an area with cesspools not sewers
- in a rural community
- downtown in a large city
- in a wooded area with large swamp white oaks
- next to a discotheque
- near an open dump
- near an airport
- on a flood plain
- next to a poultry plant
- near a freeway

Why might they have a difficult time selling the house in each case? Make a list of the conditions under which a house should not be built. Where should we build houses? (Be sure to keep in mind "different strokes for different folks.")

PURPOSE: To estimate the amount of space used by automobiles in one block.

LEVEL: 4-6

SUBJECT: Math

CONCEPT: Man has developed techniques useful in describing land and its uses.

REFERENCE: Fielder, Erica and Shaffer, Carolyn. Ecology For City Kids. San Francisco Ecology Center, 13 Columbus Avenue, S.F. 94111.

ACTIVITY: As a class, measure the perimeter of one city block. Figure out the approximate area of the block. Divide your class into four teams, each stationed on one perimeter line of the chosen block. Ask each team to record the following:

1. Number of cars parked either in the street or in driveways
2. Number of garages
3. Number of driveways and alleys
4. Number of parking lots
5. Estimated amount of space cars take on each perimeter line: 1/4, 1/2, 3/4. This could be done by pacing and measuring.

Back in the classroom, record each group's findings and estimate the amount of space used by cars for the entire block. Now, imagine that all the people on this block switched from cars to bicycles. What might they do with the extra space? Remember that private automobiles are no longer available for transportation.

PURPOSE: To closely examine construction considerations of a street or road and sidewalks.

LEVEL: 4-6

SUBJECT: Math
Science

CONCEPT: Man has developed techniques useful in describing land and its uses.

REFERENCE: Roller, Lib. Using the School and Community: An Environmental Study Area, Nashville Metro Schools, Nashville, Tenn., 1974. Title III, ESEA. ED 071 917.

MATERIALS: Level

ACTIVITY: Sidewalks and streets are so commonplace that we really never think about how they are constructed.

Many people and heavy vehicles use the sidewalks and streets. Temperature changes affect the surface and can cause cracking and upheaval which can be dangerous to people and cars as well as costly to repair. Usually a street is made of concrete and asphalt. Asphalt used to be imported from the British West Indies but now most of it is made in our country. Its tar-like substance is what is left after other chemicals have been boiled out of petroleum. Asphalt is easy to work with and it will expand and contract in the summer and winter without too much cracking. Some roads are made of asphalt and small chunks of stone. This is macadam. Concrete makes a better surface for roads but it costs more. Since concrete expands on hot days, the roads usually have spaces filled with tar. Cement walks are the same. The cracks also help keep cracks in the blocks from spreading.

Take your class outside and closely examine the streets and sidewalks in your neighborhood. Look at the center of the street. Does it appear to be level? (The "crown" is higher than the area near the gutter so the water can run into the sewer.) Use a level to demonstrate this and figure the slant. Notice the sewers. Ask the class why all streets have gutters and sewers. Even on dirt roads, drainage ditches have been provided. What happens if sewers are not large enough after a heavy rain? (Basements and streets will flood.) What is the purpose of curbs? Look at a corner. Is it banked differently? Why?

PURPOSE: To describe "the ideal recreation area."

LEVEL: 4-6

SUBJECT: Language Arts
Social Studies

CONCEPT: Esthetic resources and recreational facilities of economic and non-economic value are becoming increasingly important in leisure-time activities.

REFERENCE: Project Learning Tree. Supplementary Curriculum Guide for Kindergarten Through Grade 6. Copyright 1977 by American Forest Institute. Reprinted with permission of AFI.

ACTIVITY: Ask your students to write descriptions of their ideal recreation areas. Each student's essay might include details of the imaginary area's plants, animals, recreation facilities, geographic location, and geologic characteristics. Drawings or photographs may be used to illustrate the essay.

Encourage the students to share their essays in class, making lists of the characteristics included in these descriptions of "ideal" places. Through group discussion, identify:

- Characteristics most often included by students in their descriptions.
- Unique characteristics of any of the recreation areas.
- Any existing outdoor recreation areas that meet any student's or group of students' ideal criteria. Of the existing recreation areas that meet students' criteria, you and they could select one to visit. Plan the visit—and go there!

EXTENSIONS

1. After students have completed their essays, ask them to study the accompanying list which gives general characteristics of the different types of outdoor recreation areas established by federal legislation. Then, suggest that each student attempt to decide which designation best fits his or her ideal area.

   National Parks and Monuments: Spacious land and/or water areas so outstandingly superior in quality and beauty that it is imperative they are preserved by the federal government for the enjoyment, education and inspiration of all people. They provide a wide range of recreation such as camping, picnicking, hiking, horseback riding, sightseeing, and river floating in a natural setting, consistent with the preservation of the characteristics or features that merited their establishment. No hunting, specimen hunting, or other resource harvest is permitted, with some occasional and specified exceptions.

National Recreation Areas: Spacious land and/or water areas, including within their perimeter an aggregate gross area of not less than 20,000 acres (8100 hectares), except riverways, narrow coastal strips, or areas where total population within a radius of 250 miles (402 kilometers) is in excess of 30 million people. Outdoor recreation is the dominant management purpose of these areas, and they are designed for comparatively high-density recreation such as power boating, developed campsites and facilities, snow and water skiing. Timber and other resource management is permitted so long as recreational values are not impaired.

National Forests: Federal lands administered by the Forest Service, U.S. Department of Agriculture, under a multiple-use policy for outdoor recreation, range, timber, watershed, wildlife and wilderness purposes. The National Forests contain not only forested lands but grasslands as well. Recreation is only one of the management concerns; for instance, National Forests must also provide 1/3 or more of our softwood timber supply. Forest recreational opportunities include scenic drives, wilderness travel, picnicking, camping, hiking, skiing, swimming, boating, hunting, and fishing.

National Wilderness Areas: An area of public or Indian land (1) at least 5,000 acres (2,025 hectares) in extent, or of sufficient size to make possible its preservation and use in an unimpaired condition, (2) containing no roads usable by the public, (3) within a reasonably unified boundary configuration, and (4) showing no significant ecological disturbance from on-site human activity. These criteria permit primitive camping, hiking, horseback riding, mountaineering, snowshoeing, and cross-country skiing. Motorized machinery, resource harvesting (except some fishing and hunting) and developments are prohibited.
Note: Some of these designations overlap; for example, lands managed as wilderness areas may also be within National forests and parks.

State designations generally follow the pattern of the federal guidelines except that the areas usually contain features of state or regional interest and the area is smaller.

2. Each student or groups of students can research to determine the history of a recreation area, before and leading to its designation as a federal or state recreation area. They might also include consideration of changes since its designation as a federal or state recreation area and identify any problems now involved in its management and use.

PURPOSE: To compare short-term gains and long-term effects of forest management.

LEVEL: 4-6

SUBJECT: Language Arts
Social Studies
Fine Arts

CONCEPT: Land use management to meet the needs of successive generations demands long-range planning since options available to future generations must not be foreclosed.

REFERENCE: Warpinski, Robert, Director. A Supplementary Program For Environmental Education, Project I-C-E, Green Bay Wisconsin. Title III ESEA. ED 055 919.

ACTIVITY: Discuss with your class a hypothetical situation where maple lumber is suddenly in great demand for some new product. Ask your students to pretend that they own a large maple forest and have a chance to make a great deal of money if they harvest the maple trees in their woods. Their neighbors are convinced of the same thing so everyone in the area contracts to logging firms to cut down all the maple trees and all plan to become rich. Is it likely if all the maple owners cut down all their maple trees at the same time that all of them will become rich? Why? Why not? What might be long-range effects of such a procedure? List other industries that might be affected. Write a "before and after" account of the area and include a sketch of the way the area looks for each account.

PURPOSE: To construct a model of a farm, ranch or suburb utilizing good land use practices.

LEVEL: 4-6

SUBJECT: Fine Arts
Science
Math

CONCEPT: Physical characteristics of the natural environment are of major importance in determining land use.

REFERENCE: Foster, Albert B. & Fox, Adrian C. Teaching Soil and Water Conservation: A Classroom and Field Guide. U.S. Department of Agriculture, Soil Conservation Service, August, 1970. ED 067 218.

ACTIVITY: Building a model of a farm, ranch or suburb utilizing good land use management practices can be an excellent culminating activity following the study of land use management.

If the farm or ranch model can be based on local land use problems and conservation needs, it will be most effective in helping children relate conservation to their own home and community welfare. Teachers in city schools can relate wise use of soil and water to the everyday lives of urban children by pointing out that food, lumber, wool, cotton, and other necessities come from the soil.

Your model farm can represent the conservation plan on the farm you are studying.

The successful conservation farmer follows a plan that was designed for his particular farm much the same way a tailor cuts and fits a suit to a particular man.

The first step in preparing this conservation plan is to find a good use for each acre on the farm. The physical characteristics of the land, in combination with the climate, limit how the land can be used safely.

No two acres of land are alike. The differences include variations in slope, soil depth, inherent productivity, stickiness, wetness, texture, amount of erosion, and many other features.

Some soils may be so shallow that cultivated crops will not yield enough for profit. This kind of soil is naturally best suited to grass or trees.

Some soils are sticky when wet and form hard clods when dry. Such soils are hard to farm and may take more work to prepare for seeding and cultivating. They let water in slowly and give it up to plants slowly. This characteristic may determine what the use should be.

How much soil has been lost by erosion has a lot to do with how land can be used safely. Severely eroded slopes will need maximum plant-cover protection. Grass and trees or shrubs for wildlife are usually the best use here, although some eroded land can be reclaimed for cultivated crops if the soil is deep enough and if the slope is not too steep.

Some land slopes so much that any cultivation of the soil will result in serious erosion in spite of all the farmer can do to protect it with mechanical measures. Even just a little too much grazing or too heavy cutting of timber will have bad effects. Steep slopes will be more profitable to the farmer in the long run if used for grass or trees.

Gentle slopes, provided the soil is satisfactory in other ways, can be safely cultivated and used for crops like corn, cotton, and truck crops.

Level land that is well drained, does not overflow, has deep soil, and has no physical impediments like outcropping rock makes the best land for growing cultivated crops. Such land can be worked frequently without serious erosion hazard. Even this land needs good management to keep it productive.

After a careful study of the land and soil characteristics the farmer makes a plan to use each part of his farm within its capability as imposed by nature. This plan becomes the farmer's blueprint for his farming operations. It includes a field arrangement that puts each acre of land to work at a safe use. The field arrangement takes into consideration convenience of work for the farmer. It provides for separating cropland from grassland and from woodland. Some wildlife may be separated but all the land on the farm will be used by wildlife in some way.

After the farmer plans for the safe use of each acre of land he then plans the necessary supporting conservation practices like crop rotations, terraces, grass waterways, stripcropping, contour farming, pasture rotation, and woodland protection.

Such planning as this makes a soil conservation plan for a farm--a plan that fits the farm because it was made according to the physical nature of the land and a plan that suits the farmer's needs and abilities.

A model is the kind of activity in which all pupils in a schoolroom can participate. It should be planned in detail under your guidance as teacher. Decide what construction materials are needed, what soil and water conservation measures are to be applied, and how structures such as dams, terraces, bridges, fences, and buildings are to be modeled. The assignment of various construction details on the basis of age and grade makes it possible for all the children to share in the work.

In making plans for this project consider the sources of outside information and assistance. Where can you find out what the local soil-erosion problems are and what conservation measures are in use? What visual aids and references are available? Local representatives of State and Federal conservation agencies and organizations, including conservation farmers and ranchers, can be helpful.

The model can be a replica of the general terrain of the community in which the school is located. Or you can select a nearby farm or ranch that the class can study firsthand. Let the students see the erosion problems, then build a model showing the land as it should be used.

Models are usually built of fiber insulation board, papier mache, or a salt-flour mixture on a sturdy base. One good method is to use pieces of thick fiberboard cut to match the outlines of the different contours of the land. The pieces are stacked in the order of succeeding elevations and glued together. The edges of the layers are then filed off with a wood rasp to make the slopes smooth and even.

It you want to make a model of an actual farm or ranch, your first step is to get a contour map of it. You can see the local Soil Conservation Service technician for sample maps of local farms. He can also give you suggestions about reproducing the contours to scale on the model. If the terrain is flat you may need to exaggerate the steepness 2 or 3 times.

Make a base for the model from 1-inch lumber the size and shape of the farm. An 80-acre farm could be 2 feet by 4 feet. The first layer of insulation board should be the same size as the base.

Then cut the succeeding layers according to the contour lines and glue them together. You may be able to save material and reduce the weight of the model by having the layers overlap only a little so that the inside is hollow.

Plastic crack filler or papier mache may be useful during the final shaping. You may want to make some minor cuts and fills for roads, gullies, and other physical features.

As the first step in decorating the model, paint it with glue. While the glue is still tacky, sprinkle screened sand over it. This surface has a texture that will make it look like fields and pastures when painted suitable colors.

In deciding on the scale for the other items on the model, it is a good idea to start with the buildings. They need not be the same scale as the land; usually they can be somewhat larger. But other items such as fences, machinery, and livestock should be in scale with the buildings.

Buildings--Cut buildings from balsa or other softwood. You can do some carving but windows and doors can be painted in.

Fences--Drive dark nails or pins for fence posts and cut them off at a suitable height. For barbed wire, use fine wire fastened by a loop around each post. For woven wire cut strips of screen and push them into the modeling material; fasten with airplane glue.

Clover, alfalfa, and grass--The best way to simulate these crops is to paint the areas and sprinkle sawdust of appropriate colors over them. Sawdust coming from different kinds of machines, such as sanders, saws, chippers, and jointers, has different textures. The texture can be altered by screening. Coarse-textured sawdust is best for crops like alfalfa and clover; fine sawdust would be best for grass. Color the sawdust with a mixture of about one-fourth paint and three-fourths turpentine. Pour this over the sawdust and then spread it out to dry.

Bare soil--Fine sawdust, or the modeling material itself will give about the right texture if painted the right color.

Terraces--Loosely twisted heavy cord or small rope can be glued to the model. The areas above and below the cord or rope can be filled with crack filler shaped to give the form desired.

Corn--You can represent young corn by gluing strips of stiff burlap vertically in rows. After the glue has set, pull out the horizontal threads. Then split and curl the remaining vertical threads.

Shrubs--Cut sections from colored sponge and glue them in place. You can make isolated trees in the same way, but to represent a woodlot treat the whole area as a mass, using colored sponge.

. Models of farms can also be made with papier mache. On a sturdy base make the shape of the farm you want by bending and shaping chicken wire. Then cover it with layers of paper dipped in paste, until you have the right amount for strength and form. Add the buildings, fences, and crops as explained above.

For younger children, don't overlook the sandbox. It offers a good opportunity to make a less elaborate model. Even with sand, it is best to copy an actual farm even though you will need to exaggerate the topography.

LAND USE MANAGEMENT
ACTIVITIES
FOR THE CLASSROOM

Grades 7-9

73/74
73

PURPOSE: To learn the usefulness of land capability classification as a land use management tool.

LEVEL: 7-9

SUBJECT: Science

CONCEPT: Physical characteristics of the natural environment are of major importance in determining land use.

REFERENCE: Klingebiel, A. A. and Montgomery, P. H., Land Capability Classification. U. S. Department of Agriculture, Soil Conservation Service, Agriculture Handbook No. 210, 1961.
Dasmann, Raymond F., Environmental Conservation. New York: John Wiley and Sons, 1968, pp. 126-128. SE 008 955.

ACTIVITY: Perhaps the most serious problem in land use management is in utilizing land according to its capabilities. In many locales, marginal land has been cultivated in attempts to wring a living from lands not appropriate to such uses. This damages the land, leads to environmental problems such as those related to soil erosion, and produces poor crops.

The U. S. Soil Conservation Service has developed a detailed land classification system, in an attempt to encourage use of land according to its capabilities (See Appendix D). Factors considered in the development of the system include soil types, slope and drainage characteristics, erodibility of the soil, and other factors which may influence land capability.

Agencies such as the Soil Conservation Service and Agricultural Extension Service often will assist in working out a land classification and use plan for individuals making the request.

Depending on local circumstances, it may be possible for students to work out a land classification scheme on the school grounds, or in the vicinity of the school. Such an activity might also be conducted through use of topographic maps or soil maps, though an in-the-field component would likely be more meaningful. If possible, enlist the aid of SCS or AES personnel in completing a local survey.

PURPOSE: To study the effect of wind on sand dunes.

LEVEL: 7-9

SUBJECT: Science

CONCEPT: Man has developed techniques useful in describing land and its uses.

REFERENCE: Marine and Environmental Studies Manual. Cranston and Warwick, Rhode Island Public Schools, Sept., 1973. Title III, ESEA. SE 022 700.

MATERIALS: Large stream table or sand box, large box or sheet to catch sand, fan or vacuum cleaner (reversed) for wind source.

ACTIVITY: Hurricane Carol of 1954 caused great damage to Rhode Island's shoreline. Houses were torn apart. Large buildings were weakened by water washing the ground from under them. Roads were destroyed.

Why was damage from this storm so great? Many engineers said that man had removed some of the natural protection. This natural protection was in the form of sand dunes. When the sand dunes were smoothed out, the wind and high water had nothing to stop them. This caused more damage to property than there should have been.

What are sand dunes? How are they formed? These are questions man has to answer if he is to understand the oceans and their shores.

Sand is made up of small chips of rock. These chips are so small that they are easily carried by both wind and water. As the wind blows across the sand it picks up pieces of sand. A strong wind can carry a lot of sand. If the wind slows down it drops the sand. A dune may be formed in this manner.

Make a number of hills and valleys in the stream table, keeping the land sloping upward toward the box.

Place a large cardboard box, open at one end, on the land portion of the stream table. Use fine, dry sand to represent sand dunes. Place a stone and a small bushy plant on the sand. Create wind by locating a fan at the end of the stream table, facing the open end of the box. Have students observe how the wind affects the dune shapes and locations. Ask the following questions:

What is happening to the sand on the front of the dune?

What is happening to the sand at the top of the dune?

What is happening to the sand on the far side of the dune?

What is happening to the sand around the stone?

What is happening to the sand around the bush?

Do sand dunes move?

Sketch a cross-section of a coastal terrace on the chalkboard. Ask students how such a coastal line might have been formed. Summarize all suggestions on the chalkboard and ask the class which suggestions seem most logical.

PURPOSE: To compare manipulated and nonmanipulated habitats preserved for wildlife and consider how land can be preserved for wildlife and at the same time provide education and recreation for man.

LEVEL: 7-9

SUBJECT: Science

CONCEPT: Land use management to meet the needs of successive generations demands long-range planning since options available to future generations must not be foreclosed.

REFERENCE: Environmental Education Curriculum Infusion Units. General Education and Curriculum Services, Albany, New York. ED 137 056.

ACTIVITY: Discuss the role of the state government in the establishment and continuation of game preserves. Have students plan and arrange field trips to manipulated and nonmanipulated wildlife refuges.

During the field trip to a nonmanipulated wildlike refuge, enlist a teacher-naturalist to instruct the students concerning the importance of a habitat, the methods employed in this state to preserve various habitats, and the need for developing new game preserves and nature centers. Ask the naturalist to also discuss problems and possible solutions regarding peoples use of wildlife/refuge areas.

Repeat the same field trip procedure to a manipulated wildlife refuge, noting in particular the differences between nonmanipulated and manipulated habitats.

Upon return to the classroom, direct students to write a summary of their observations and experiences on the two field trips.

The following questions might also be discussed:

- Why is it important to consider the type(s) of habitat prior to the development of a game preserve or wildlife management area?
- What roles do local, state, and federal governmental agencies play in the establishment and continuation of game preserves?
- How can natural areas be preserved for wildlife and still provide recreation and education for man?
- Should humans or wildlife have priority over the use of the land inhabited by wildlife? Explain.

- How can we hope to balance local land use priorities for ourselves and wildlife as well?

- As a class, prepare a topographic map or scale model of an "ideal" manipulated or nonmanipulated wildlife refuge.

PURPOSE: To participate in wildlife management projects.

LEVEL: 7-9

SUBJECT: Science
Social Studies

CONCEPT: We have "legal" ownership of some land resources like real estate and control over others during our lifetime, but ethically we are "stewards" rather than owners of the land.

REFERENCE: Fox, Charles E. Activities for Teaching Forest Conservation; Grades 5 though 9. Forest Service, U.S. Department of Agriculture, January, 1958.

ACTIVITY: The activities suggested require detailed information which can be obtained from the habitat - improvement bulletins issued issued by the conservation department of your state. Other useful bulletins are:

"Improving the Farm Environment for Wildlife," Fish and Wildlife Service, U.S. Dept. of the Interior, Washington, D.C.; and "The Farmer and Wildlife," Wildlife Management Institute, Washington, D.C. A local conservation officer hould also be consulted. In any rural or city-perimeter school, the following projects can be carried out close at hand, making it possible for pupils to participate and check on results:

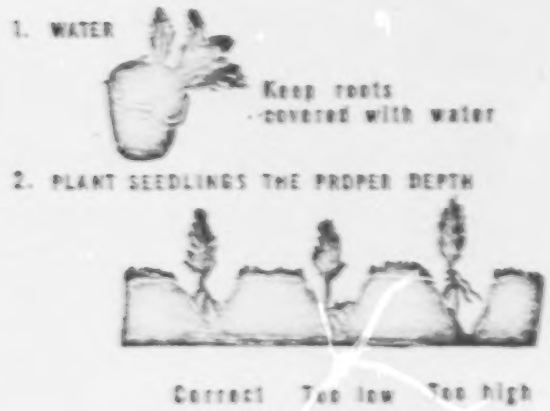
1. Wildlife foodpatch. A patch of food for use in winter by wildlife may be either planted specially, or a portion of a farm crop may be left unharvested and protected from domestic livestock for use by wildlife. To be effective, the patch must be at least 1/4 acre in size, and a better minimum is 1/2 acre. Corn and soybeans are the staple foods. Be sure the food lasts through the winter; birds will learn to be dependent upon your supply.

2. Feeding stations. When little natural food is available as during sleet storms, heavy snows, and in depleted areas, artificial feeding stations are needed for songbirds; for gamebirds such as bobwhite quail, pheasants, and grouse; and for rabbits and squirrels. These stations provide food, shelter, and protection from predators. There are various types: lean-tos, boxes, tepees, brush piles, down-timber. Food may be provided in a number of ways -- scattered in chaff or straw, ear corn impaled on spikes or placed in a hogwire basket, etc. Grit (quartz from poultry feed store or fine gravel) should always be supplied along with the food. Feeding should be started in November as "bait" so that the animals will know where to find food when "hard times" come in winter or early spring.

3. Wildlife planting. Improve an existing windbreak or forest plantation by adding plants for wildlife food and cover. Useful shrubs are grape, viburnum, highbush cranberry, dogwood, mulberry, elderberry, and hazelnut. A helpful reference is A Book of Wayside Fruits by Margaret McKenney, Macmillan Co. Consult local game warden or forester for advice on species, when to plant, source of planting stock. Most state conservation departments furnish wildlife-planting material free or at cost. Roadside plantings, natural timber patches, forest plantations, and farm windbreaks are usually inadequately stocked with useful wildlife plants. There is sure to be an area near any school waiting for just such a development -- except possibly a school in the heart of a big city, and even there parks may provide an opportunity. Trees and shrubs together will provide an excellent combination. If the trees are all hardwoods, the planting of conifers should be included in the plan.

4. Improve the school grounds. Obtain permission from school officials to plant a wildlife cover of trees and shrubs, plant a multiflora-rose hedge, a windbreak of conifers, a memorial grove in honor of a school or community conservation leader, or something similar. Consult conservation officers for information on species, when and how to plant. If possible, arrange for a little dedication ceremony after the area is planted.

THREE IMPORTANT RULES FOR PLANTING



3. TAMP SOIL

With hand

With foot

PLANTING WITH A SHOVEL

Wedge hole
Scrape back
sod

Remove wedge
of soil

Spread roots
flat & deep,
tamp firmly

PURPOSE: To investigate littering as a negative land use.

LEVEL: 7-9

SUBJECT: Science
Social Studies

CONCEPT: Esthetic resources and recreational facilities of economic and non-economic value are becoming increasingly important in leisure-time activities.

REFERENCE: Junglas, Mary, et al. Environmental Learning Experiences: Biophysical, Junior High School. Center for the Development of Environmental Curriculum, Willoughby-Eastlake City Schools, Willoughby, Ohio, 1974, p. 57. Title III, ESEA. ED 099 229.

ACTIVITY: Quite often, land that is not maintained for a specific use becomes "used" in a negative sense; that is, it becomes a dumping ground for trash.

Have students search for vacant lots that attract trash. Give descriptions of these lots, particularly of the kinds of things found there. Look for areas where dumping occurs. Map all areas of dumps and littered lots.

Questions:

1. Who owns these vacant lots?
   a. What does the city do about landowners that do not correct these situations?
   b. How strict are the laws and how much are they enforced?
   c. How often is trash picked up?
2. How dangerous are objects found there to youngsters who play in these areas? What about the aesthetic values such lots have on the environment?
3. How is dumping controlled?
   a. What effect do abandoned cars have on this area of trash?
   b. How do junkyards control their situation?
   c. Is there any kind of forceful upkeep by the city for junkyards?

Gather data relevant to vacant lot litter:

1. Location of lot
2. Physical condition of property
3. Description of trash
4. Owner of property
5. Past history of the uses of the property
6. Past history of legal prosecutions (if any)

PURPOSE: To investigate a land-fill.

LEVEL: 7-9

SUBJECT: Science
Social Studies

CONCEPT: Increasing population and per capita use of resources have brought changed land to man or resource to population ratios.

REFERENCE: Junglas, Mary R., et al. Environmental Learning Experiences: Bio-Physical; Junior High School. Center for the Development of Environmental Curriculum, Willoughby-Eastlake City Schools, 1974. Title III, ESEA. ED 099 229.

ACTIVITY: Landfills are most often studied from an environmental pollution point of view. However, they also present interesting implications for land use, partly in that they themselves are land users and partly because their presence has an influence on land use patterns in their vicinities.

Ask your students the following questions:

Where is garbage taken?

How is it disposed of?

Is incineration used?

If so, how complete is the incineration?

Is garbage taken to a landfill?

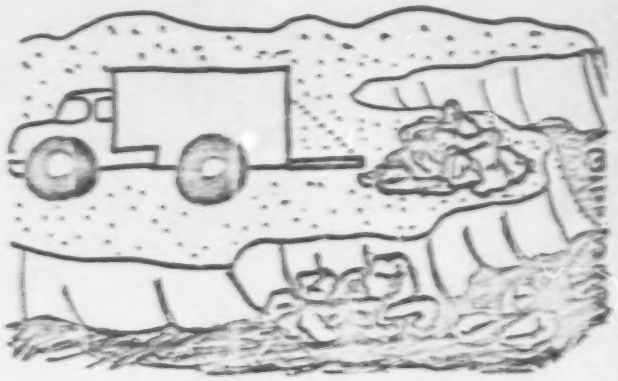
If so, where is it located?

What are the techniques used here?

How is it handled?

What precautions are used?

What is the life of a landfill?



Contact a company that maintains a landfill. Ask about procedures followed at the site. Chart all cities using the fill. Get estimates of proportional amounts deposited by each client. Look for evidence of environmental influences such as run-off, changes of terrain, damage to streams and trees, and air pollution. Determine if any local environmental groups have researched the landfill. Analyze deposition samples for constituent make-up. Sample for presence of diseases and amount of transmittable bacteria. Observe other landfills as to how they were developed for use after the filling was completed and the structure covered and closed.

PURPOSE: To understand the importance of soils in determining appropriate land use.

LEVEL: 7-9

SUBJECT: Science
Social Studies

CONCEPT: Maintaining, improving, and in some cases restoring soil productivity is important to the welfare of people.

REFERENCE: Gail, Peter A., et al. A Curriculum Activities Guide to Watershed Investigations and Environmental Studies, pp. 59-63. ED 104 651.

ACTIVITY: Soil is the substrate on which all else rests. Many land use problems and water pollution problems arise from misuse of soil resources. Yet, people are often surprised with the soils used for consideration in land use planning. In all the talk about water, noise and air pollution, little attention is sometimes accorded to soils.

Subdivisions, shopping centers, highways and many other manmade structures are often built with very little regard for the characteristics of the soil they are built upon. The results include major changes in drainage patterns, erosion, inadequate treatment of septic wastes, broken asphalt, flooded basements, major flooding, filling of ponds and lakes and destruction of trout streams. These tragedies happen because planning and zoning boards often have very little appreciation of their opportunities to minimize environmental damage during building.

Activities for teachers use to involve their students with local soils follow.

A. Sean Reilly's Approach to Soils Mapping and Land Use Planning

Step 1. Have students bring in a bag of soil from their backyards or from predetermined locations in town. Mark the locations on a reference map. Have them dig a pit 2 to 4 feet deep. Ask them to notice, when digging, whether there are distinct layers, and determine how wide each layer is. Have them record this on a sketch map.

Step 2. In class, discuss the general characteristics of soils and explain the various soil classes (silts, clays, loams, sands, and the intermediates between them). Then divide the class into small groups. Place the soils they have brought into numbered buckets. Wet them, if necessary, so that soil in all buckets is moist, but not soupy. Start each group (5 or 6 members) with one bucket of soil. Have

them feel it, smell it, do anything they want, and come to a consensus about which soil class it belongs to. Record this on paper. The buckets are passed between groups until all groups have worked with each soil and recorded their findings. The groups report their findings. The teacher then takes each bucket, determines its class by feel, and explains the reasons for classifying it as he does. Students then see if they can, by feel, come to the same conclusion as the teacher. Questions, such as "what kinds of rocks and materials did these soils come from?"; "What is each soil good for?"; and "Are there limitations on soil use, or critical soils areas?" might follow, and lead into Step 3.

Step 3. Mapping soils

Alternative 1. Have students

a. draw a map of a local open area (it should be in an area of heterogeneous topography and vegetation types, including a stream or other wetlands area if possible).

b. sample soils in each area and plot the characteristics on the map.

Alternative 2. If no such area is available, students can draw a map of the watershed, and draw in local features such as mountain ridges, swamps, local streams, hills, etc. and predict the types of soils they would expect to find in each area.

Step 4. Once this map is made and predictions recorded, students then can go into the watershed or local area, sample the soils, and determine how accurate their predictions were.

Step 5. Have students, preferably in small groups, discuss what uses they think each soil could support (i.e., farming, heavy buildings, light buildings, roads, buildings with cellars, parks, football fields, etc.). The teacher should meet with each group and help them with their discussions.

Step 6. Have each group present its decisions to the class. They should state what they decided to use each soil for and why (e.g., no buildings should be placed on silty or clay soils because they usually flood over, or are soft. Heavy buildings should go on rocky or firm soil areas. Farms should be on rich loamy soils, etc.).

Step 7. Have students find out if the town has used soils information on its zoning and planning. They can contact the local environmental commission or planning board and ask for a member to come and speak to the class about critical soil areas in town.

A critical soils area is one which should be used only for parks or recreational land and not developed. Examples include soils on steep, erosion-prone slopes, flood plains, swamp or wetland soils, heavy clay soils, etc.

Step 8. If soils information is not now used by the local zoning board, students can plot critical soils areas within the watershed on their map using SCS Soil Survey maps and present their report to local officials. They can then follow-up by watchdogging projects proposed by developers for these areas.

B. Kaye Widmer's Approach to Soil Studies

The intent of this section is to give the teacher and students a series of activities with which they can investigate the relationship of the soil to the water cycle.

UNIT 1—WHAT AFFECTS HOW FAST THE WATER ENTERS THE SOIL?

Step 1. Discuss how does the type of soil (clay, sand, loam, gravel, etc.) affect the rate of infiltration, and design experiments to test the ideas that are presented. How does adding organic matter to the top of sandy soil alter the rate of infiltration? How would the rate of infiltration affect the amount of ground water in the area? How would infiltration affect runoff? What could be done to improve the infiltration rate of a soil?

Step 2. Students investigate infiltration rate of soils under different types of vegetation (pines, oaks, grasses, etc. to determine if vegetation changes the infiltration rate of soils. The soils may also be chemically analyzed and correlations made with vegetation and infiltration rate.

Step 3. Investigate the infiltration rate of subsoil. How does this compare with the infiltration rate of topsoil? What happens to the topsoil when a housing development is built in an area?

Step 4. Using soil and topographic maps determine where the rate of infiltration is low in the watershed. Why is it low in these places? How would the low infiltration rate affect the amount of runoff in these areas? The ground water? What are some ways the infiltration rate could be increased so the runoff from an area is decreased? How could we find answers to these questions?

UNIT 2—INVESTIGATING THE PERCOLATION RATE OF THE SOIL.

Step 1. Students investigate how particle size of the soil affects percolation rate by timing percolation rates in different types of soils—sand, gravel, etc. How does particle size of the soil affect the amount of hygroscopic water retained by the soil? How would the amount of water retained by the soil affect the type of vegetation in the area?

Step 2. Students investigate how the addition of varying amounts of organic matter affects the percolation rate and the amount of hygroscopic water retained by the soil. How would different types of vegetation affect the amount of organic matter in the soil? How would this affect the hygroscopic water in the soil?

Step 3. Students compare the percolation rate of dry and wet soils of the same kind. How would this affect the amount of runoff from the soil?

Step 4. Students determine the percolation rate of the soils in their own yards. They put the percolation rates on a map of the town, then put in the maps where houses are that have constant trouble with their septic system or basement flooding. This can then be compared to soil type maps of the area. Why is the percolation test required before a house can be built in areas where individual septic systems are used to dispose of sewage? If the percolation rate were very poor, how might the percolation rate be improved in a particular area?

Step 5. How might the percolation rate and amount of hygroscopic water in the soil affect the type of plants which can be successfully grown in an area? How might this affect the types of plants you might choose to plant in a particular area?

Step 6. Students determine the amount of water and soluble chemicals such as salt that will dissolve and percolate through the soil. The water recovered from the plastic column and the amount of chemical weighed should be compared to the original amount. If different water soluble chemicals are stored on top of the soil, how much of the chemical percolates through the soil for a given amount of water? How might this affect the quality of the ground water? Are there areas in the community where there are water soluble chemicals stored on the ground?

SUGGESTED TECHNIQUES FOR THE ACTIVITIES ABOVE (modified from Curriculum Activities Guide to Water Pollution and Environmental Studies).

A. Soil Infiltration

Equipment: coffee can, water

Remove both ends of a large can (2-3 lb. coffee can) and set the can into the ground. Pour a known quantity of water into the area enclosed by the can and calculate the time for the water to enter the ground.

B. Soil Percolation

Excavate a hole 15 cm. in diameter and 30 cm. deep. Dig smaller holes around this hole at varying distances from it. Fill the first hole with water that has a tracer dye in it. Periodically check the smaller surrounding holes with blotter or other absorbent paper to check for water flow and the appearance of the dye.

C. Soil Percolation and Infiltration Inside

Set up a plastic column 3/4 filled with the type of soil being tested. Pour a known quantity of water into the top of the tube and determine how long it takes for the water to reach the bottom of the tube and start to drain out. This time would be the percolation rate of the soil type being tested. The time it takes for the water to enter the soil would be the infiltration rate of the soil type. If the water which has drained through the soil is collected and the amount measured, the amount of water (hygroscopic water) remaining behind in the soil can be found by subtracting the amount drained from the amount poured in.

Resources:

The local office of the Soil Conservation Service can provide you with a great amount of help. You will find their address in the Yellow Pages under Federal Government, Department of Agriculture. Among the information they can provide are:

a. Soil survey information on your watershed. Maps and interpretation sheets.

b. The pamphlets, Know the Soil You Build On, SCS Bulletin #320, Controlling Erosion on Construction Sites, SCS Bulletin #347, Conservation Plans for Developing an Area, SCS Program Aide #1029, are all available free.

c. Demonstrations by the district soil conservationist on how to do a soil survey.

d. Help in developing specific recommendations for erosion control for projects the class may wish to undertake within the watershed.

In addition, resources in local universities include soil scientists in the agricultural school and civil engineers.

PURPOSE: To identify factors related to non-development of land in metropolitan areas.

LEVEL: 7-9

SUBJECT: Science
Social Studies

CONCEPT: Physical characteristics of the natural environment are of major importance in determining land use.

REFERENCE: An Environmental Syllabus: Grades 10, 11, 12. New York State Education Department, p. 91. SE 022 615.

ACTIVITY: Secure aerial photographs of a metropolitan area; the closer to home the better. If aerial photographs are not available, it may be appropriate to use U.S. Geological Survey (USGS) topographic maps. Methods of securing either aerial photographs or topographic maps are indicated in Appendix C.

Investigate the photos or maps: attempt to locate areas which are apparently unused, despite the overall population density. Discuss why such areas are unused. Among possible reasons will be land capability (see p. 254), zoning, etc. Are there advantages to the lack of development of such areas? What are the disadvantages? What might it take to make them usable? Should this be done? Why, or why not?

PURPOSE: To evaluate the compatibility of existing land uses with natural conditions.

LEVEL: 7-9

SUBJECT Science
Social Studies

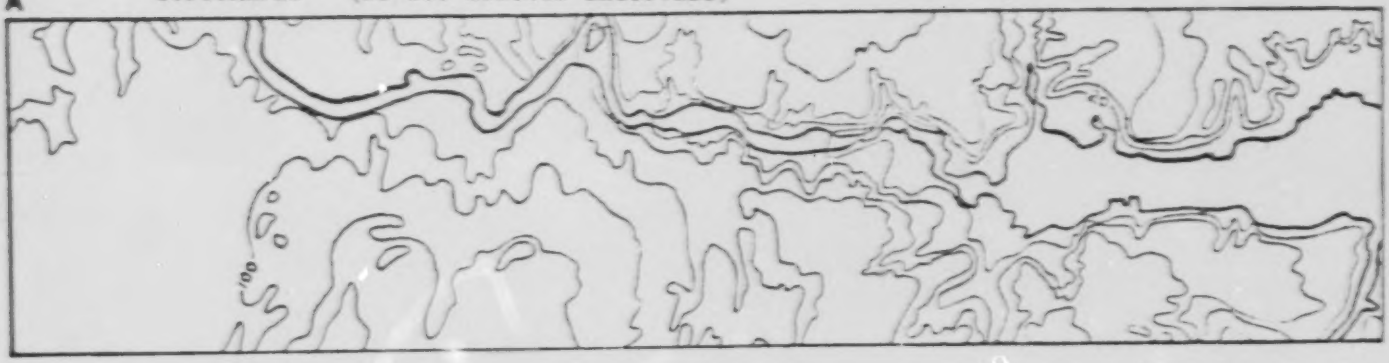
CONCEPT: Physical characteristics of the natural environment are of major importance in determining land use.

REFERENCE: Bennett, Dean B. & Willink, Wesley H. Junior High School Environmental Education Teacher's Guide: The Human Environment. Yarmouth, Maine School Dept. 1975. Title III, ESEA ED 121 567.

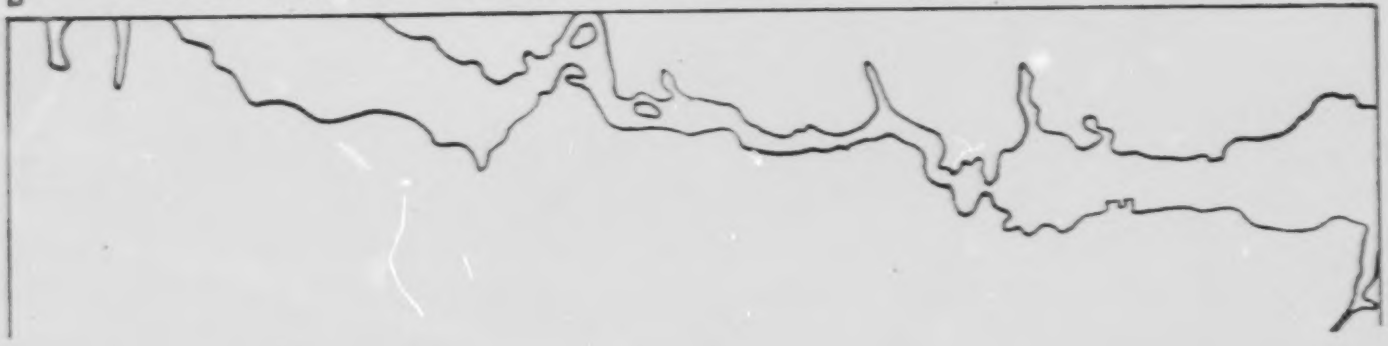
ACTIVITY: You will need the following overlays for this activity:

OVERLAYS

A TOPOGRAPHY (20-ft. contour intervals)



B FLOOD HAZARD AREAS (100-year flood plain)



slopes over 15%

unsuitable soils; i.e., tidal marsh

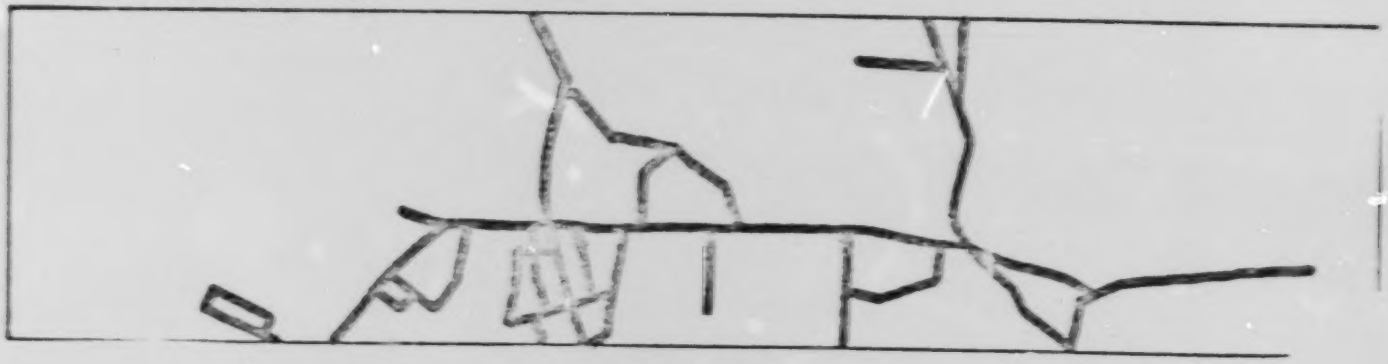
severe limitations for development

suitable for development with sewer

suitable for septic tank

C LAND SUITABILITY

D SEWERAGE FACILITIES



and the Human Settlement Map (below) (locations of existing structures).

With your class, use the following procedures to evaluate the compatability of existing land uses with natural conditions:

1. Topography Analysis

   Locate three (3) slopes which are the highest and steepest by placing the Topographic Map overlay on the Human Settlement Map. Mark them (S). Also, locate the highest area on the map and label the general location (H). Summarize on the overhead transparency and discuss the effects of the highest and steepest areas on land uses.

2. Flood Hazard Analysis

   Place the Flood Hazard Area Map overlay on the Human Settlement Map. Are there any buildings in the flood plain? If so, mark them with an (F). Discuss the effects on land use planning.

3. Land Suitability Analysis

   Place the Land Suitability Map overlay on the Human Settlement Map.

   1) Are there any buildings on slopes over 15%?
      If so, how many? ____

   2) Are there any buildings on unsuitable soils, such as tidal marsh?
      If so, how many? ____

   3) How many buildings are there on soils having severe limitations for development? ____

   4) How many buildings are there on soils suitable only for development with sewer which are currently unsewered? ____

      To check for this, place Sewerage Facilities Map overlay together with the Land Suitability overlay map and place both over the Human Settlement Map. Count the unsewered homes which are already in areas suitable for development only with public sewer.

   Locate potential pollution problem areas and label these with the symbol (P).

   Summarize on overhead transparency and discuss.

PURPOSE: To consider the environmental factors involved in growing and using live Christmas trees vs. artificial Christmas trees.

LEVEL: 7-9

SUBJECT: Science
Social Studies

CONCEPT: Land use management to meet the needs of successive generations demands long-range planning since options available to future generations must not be foreclosed.

REFERENCE: William F. Cowen, Jr. Extension Forester, The Ohio State University, Columbus, Ohio.

ACTIVITY: Christmas tree farms are a multi-million dollar industry in this country. In recent years, there has been publicity criticizing the use of the land and the cutting of live trees for this purpose when there are artificial trees available. This activity is designed to help students look at several factors that should be considered before arriving at such "environmental decisions."

Survey your class to determine how many of their families use or cut live trees for Christmas, how many use artificial trees and how many do not have a tree of any kind. Discuss which they believe to be the most un-wise use of our natural resources.

Point out the following factors for consideration: A standard size pine tree takes a 6' by 6' area (36 sq. st.) and approximately seven years to grow. It can be grown on unused land and may even help prevent erosion. A natural energy supply (the sun) is utilized during the tree's growing years. If the land becomes needed for another use (growing food, industry, recreation, etc.) it is a relatively easy process to clear and convert it.

Artificial trees are made of aluminum and/or plastic. Aluminum comes from bauxite, a finite resource. It must be mined and the process of mining consumes a large amount of electricity --- an expensive factor during the current energy crisis.

Plastic has either a petroleum or coal base --- another energy concern --- and, converting these finite resources to plastic is also a very costly process.

An artificial tree may be used for several years. People that use live trees replace them yearly.

- Some people may drive a considerable distance to pick out a live tree. The amount of gas used in the family car is another factor.

Thus, the controversy of live vs. artificial trees has environmental trade-offs on both sides. Ask your class to think of other environmental controversies and name the trade-offs on all sides of the question considered.

PURPOSE: To investigate regulations and practices concerning subdivision development.

LEVEL: 7-9

SUBJECT: Science
Social Studies

CONCEPT: Zoning is a practice in which land uses are prescribed based upon value judgments regarding the needs of society.

REFERENCE: A Place to Live: The Yearbook of Agriculture 1963. United States Government Printing Office, 1963, pp. 469-473.

ACTIVITY: Attempts to bring order into urban growth and development have generally been through initiation and application of zoning and subdivision regulations that specify, mostly in negative terms, the location and manner in which land might be cut up into individual lots and parcels for row houses, apartments, and one-family homes. These efforts have been aimed primarily at separating non-compatible land uses, such as keeping industry out of residential areas, etc. They are generally viewed as methods of guaranteeing the integrity of suburban residential development, of keeping "undesirable" development out of "preferred" residential areas.

However, zoning and subdivision regulations often are not developed with environmental considerations in mind. In many locales, such factors as soil capability, topographic and drainage considerations, and the like have not received the attention needed, leading to inappropriate development. A separate, but equally important, consideration is the removal of prime agricultural cropland from production as it is replaced by housing, industry, or commerce.

Also, legal stipulations of uniformity within any one zoning district may produce repetitive patterns of monotony and aesthetic sterility. For example, rectilinear development (Figures 1 and 2) based on minimum lot sizes "has absorbed land at accelerated rates without producing increased amenity, desirable living, economy of layout, convenience of access, or preservation of rapidly diminishing open space."

Two modifications in subdivision planning furnish at least partial answers to the problems generated by rectilinear development: curvilinear, or contour, development, and cluster development.

Students should investigate the types of developments found in their own localities, perhaps in their own neighborhoods, and compare them to contrasting types nearby, if there are any.

An appropriate investigation would be to find out the zoning and subdivision regulations under which development took place, what allowances have been, or might be, made for "cluster" development, etc.

A particularly interesting investigation in many localities involves the determination of how land and the neighborhood was utilized prior to development, what environmental considerations were taken into account during development, and what environmental problems currently exist which might have been prevented, had appropriate planning been conducted. Appropriate resource persons who might be contacted for information include city and county planners, zoning officials, Soil Conservation Service personnel, landscape architects, and local developers.

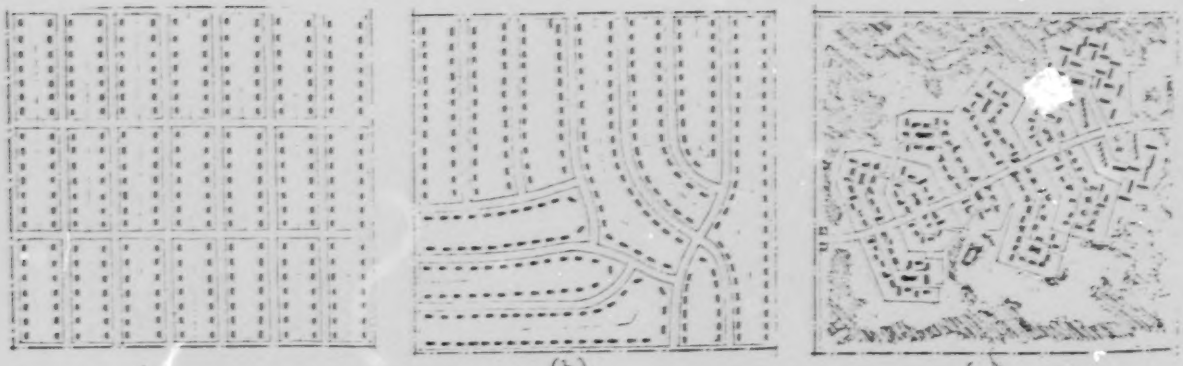
"The cluster principle contemplates the arrangement of dwellings in groups, courts, or clusters on smaller sites than those required by conventional subdivision planning or zoning specifications. The resulting differential in lot areas is then consolidated into open space for conservation and recreational uses for the common benefit of the adjacent residents with the overall density—that is, the total number of families to the acre in the development—remaining substantially the same as in a conventional layout."

"The principal advantages include flexibility in arranging building and open-space areas to fit the physical characteristics of the site; variety and diversity of site and architectural grouping; preservation of natural and topographic features; economy in the length of streets and utilities; and freedom from through traffic."

"Obviously, if this type of development is to be realized in areas where regulations of public land use are in effect, provisions permitting cluster planning must be present in zoning and subdivision codes."

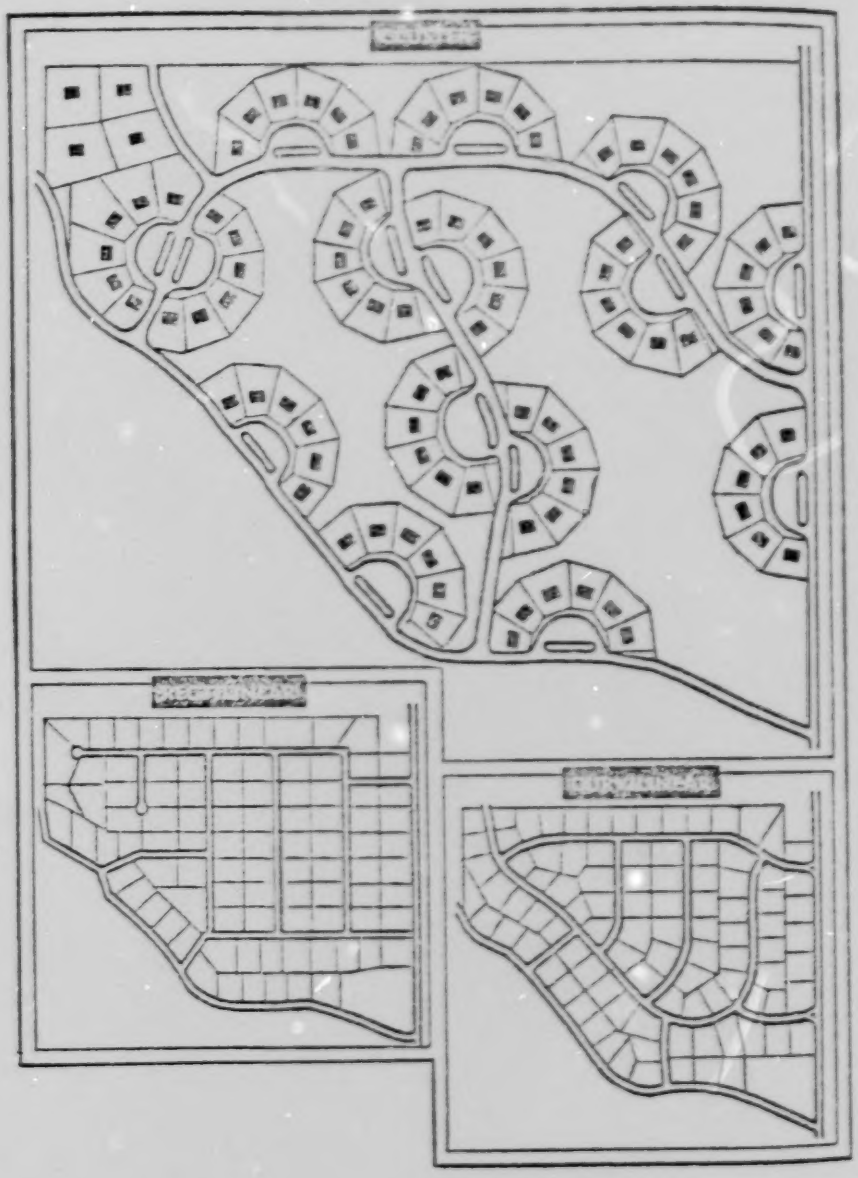
"The cluster concept seeks to realize the objectives by grouping homes within and around common open space, with greater economy in streets and utilities and with substantial increase in the attractiveness and livability of the entire development. Thus, the zoning code needs to be based essentially on density—maximum number of families on an acre of development, rather than minimum dimensions or size of the single lot."

Figure 1.



The diagrams illustrate three treatments of a site of approximately 70 acres: (a) Traditional "grid-iron"; (b) curvilinear or "contour"; and (c) cluster, with surrounding common areas. The same number of families is maintained in each layout.

Figure 2.



Alternative treatments of an actual site with hilly terrain. Conventional schemes provide for 94 lots of 1 acre each. Cluster lots were reduced to three-fourths acre so that about 24 acres of common area remained. Savings claimed for the cluster plan include 6 thousand lineal feet of street and improved circulation and storm drainage, compared to 12 thousand lineal feet and 11,600 lineal feet for the rectilinear and curvilinear schemes, respectively.

PURPOSE: To help the students understand the problems involved in making decisions concerning wise use of land.

LEVEL: 7-9

SUBJECT: Science
Social Studies

CONCEPT: Natural resources are unequally distributed with respect to land areas and political boundaries thus, conflicts emerge between private land use rights and the maintenance of environmental quality for the general public.

REFERENCE: Larry Steider, General Science Teacher, Highland Jr. High, Sparta, Ohio.

ACTIVITY: There is little disagreement about the fact that our population is increasing and will continue to do so. Accompanying this increase in population will be the increased need for goods and services. There are times when decisions have to be made concerning how our resources are to be used to provide these goods and services.

The following role-playing situation will help students make decisions as to the wise use of land. Mr. Jones is a farmer who owns a farm of 500 acres at the outskirts of a rapidly expanding city of 100,000 people. Half of his farm is covered with forest, the rest is very productive agriculturally. Mr. Jones enjoys his work as a farmer very much. Recently, Mr. Jones has been receiving much pressure from many sides to sell his farm.

Mr. Allen, a local contractor, would like to buy the property to build a housing development that would provide housing for a rapidly rising population. Mr. Bates, the mayor, feels the site would be perfect for a much-needed sewage treatment plant because of the location next to a river and its proximity to the growing part of the community. A group of businessmen, headed by Mr. Smith, feel that this area, which is easily accessible to a main highway, would be a perfect place for a shopping center. A civic action group led by Ms. Fields would like to see the county or city buy the farm and utilize the forest and water resources as a camping and recreation area. The president of the state univeristy is very much interested in procuring the site for a branch campus.

Due to the fact that his farm is taxed on market value, which is very high, and the fact that prices for farm products are so low, Mr. Jones is forced to sell his farm. He has set his price and is aware of all the prospective buyers. Mr. Jones, being civic-minded, wants to make a decision which will most

benefit his community both now and in the future. He and his lawyer call a meeting of all the groups that are interested in purchasing the farm.

As a class, set up this meeting and act out the various roles. Select a person to represent the mayor, the building contractor, the businessman, Ms. Fields, the university president, and Mr. Jones' lawyer. (Note: There may be other rules you would like to include.)

Have the lawyer conduct a meeting with all the above. He must allow time for each participant to state his case as to why he thinks the farm should be sold to him. The remainder of the class will represent Mr. Jones. They can be permitted to ask questions after each participant has stated his case. When the discussion has ended, have each student decide privately who he thinks the land should be sold to.

You may later want to divide the class into groups of 4 or 5 and discuss their decisions. Have them come to a consensus of opinion.

This case may be highly simplified and not represent the way these types of decisions are usually made but it does help students make decisions about land use management.

PURPOSE: To understand that the characteristics of prime agricultural land also make it valuable for competing land uses.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: Land use policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.

REFERENCE: Klingebiel, A. A. and Montgomery, P. H., Land Capability Classification. U.S. Department of Agriculture, Soil Conservation Service, Agriculture Handbook No. 210, 1961.
Dasmann, Raymond F., Environmental Conservation. New York: John Wiley and Sons, 1968, pp. 128-129. SE 008 955.

ACTIVITY: The land capability classification scheme presented in Appendix D is framed in terms of agriculture and related land uses; little attention is given to industrial, commercial, transportation, and housing uses.

As populations continue to grow, such uses are increasingly competitive with the more "traditional" agricultural uses, and for economic reasons often remove prime agricultural lands from such uses. Topics worthy of discussion or investigation include:

1. Why are prime agricultural lands often taken up for non-agricultural uses? (Relate this to land capabilities desired for industry, commerce, transportation, and residential development).

2. Locate in the community areas that were at one time utilized for agriculture; how and why have land uses changed?

3. Locally, what uses are made of land classified as VII or VIII? Why is this so?

PURPOSE: To learn how local zoning decisions are made.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: Natural resources are unequally distributed with respect to land areas and political boundaries thus, conflicts emerge between private land use rights and the maintenance of environmental quality for the general public.

REFERENCE: Garalasco, Chris, Local Implementation and Land Use Decision Making, Area Cooperative Educational Services, New Haven, CT, Environmental Education Center, ED 133 216.

ACTIVITY: As a "starter" to involve students in a study of local zoning, the following simple worksheet may be of use.

Are you familiar with your community's zoning ordinances and the people responsible for enforcing the regulations outlined in the ordinance? To be a successful land use decision maker, you must have this information at hand. Take time to complete this sheet now.

1. Has your town adopted a zoning ordinance? _____

2. How many members preside on your zoning commission? _____

3. Who is responsible for zoning enforcement in your municipality? _____

4. Does the Zoning Board of Appeals hold hearings on certain days of the month? _____ If so, when? _____

5. What right does you community have to adopt a zoning ordinance? _____

6. Do you know how your neighborhood is zoned? _____. What are the types of development permitted in this zone? _____. What type of zone is adjacent to the zone in which you live? _____. Are you satisfied with this arrangement? _____.

PURPOSE: To discover examples of good and poor planning in the neighborhood.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: Land use responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: Environmental Education Curriculum Infusion Units, General Education and Curriculum Services, Albany, New York. ED 137 056.

ACTIVITY: This activity is designed for pupils with limited reading ability, but can be adapted for all ability levels. It is intended for small committees of pupils interested in the topic and in the use of photography as a reporting media.

This mini-project can be used as an introduction to a larger unit on neighborhood, block, or town planning. Consider the following understandings:

"Expansion of the metropolitan area has created serious problems."

-deterioration in the central city: physical decay and and mounting problems
-antiquated planning

"Urban planning is basic to the future of the metropolitan region."

"Metropolitan areas have simlar basic problems."

-meaningful use of space
-adequate and decent housing

Discuss the present condition of the neighborhood.

What factors or conditions could be used to define well-maintained properties?

Are there any instances of poorly-kept buildings?; Of poorly-kept grounds around homes and apartment buildings? Give examples.

Are there any instances of particularly well-kept buildings and well-cared-for properties? Give examples.

Form a committee of two or three pupils to investigate and photograph well-maintained and/or well-planned and poorly-maintained and/or poorly-planned properties in the neighborhood surrounding the school. (Committee members should own or have access to the photographic equipment needed for the project. One camera/photographer is sufficient for each committee.)

Form a committee of two or three pupils who live in a neighborhood away from the school to investigate and photograph well-maintained and/or well-planned and poorly-maintained and/or poorly-planned properties within their own neighborhood. (These committees may be formed along geographical lines. The members of each committee would live in the same neighborhood.)

Before the committees go out to take pictures, take them on a walking tour of the school's neighborhood.

- -Which areas are well planned? Which properties are poorly planned? Which properties are well maintained? Which are poorly maintained?

- -How would you go about photographing these properties to illustrate their condition?

Once the committees have completed their photographic investigations, evaluate and edit the results.

- -In what order should the slides be projected to best express the committee's point of view about what is good and bad in the planning and care of the neighborhood investigated?

- -Do the slides actually depict well-planned, poorly-planned, well-maintained, or poorly-maintained properties? Explain.

- -How could the poorly-planned areas have been improved in their original planning? How could they be improved now?

- -What might explain why properties in the same neighborhood are so markedly different in planning and maintenance?

- -What tactful ways could be found to persuade property owners to provide better maintenance for their property?

This activity might be expanded as follows:

- -Plan a class symposium on the topic, "Our neighborhood should have a master plan."

-Have students plan and conduct a clean-up project for poorly-maintained, pubilicly-owned property in the neighborhood.

-Have students conduct research to determine which public agencies should be contacted about poorly-maintained, publicly-owned property in the neighborhood. Write letters to these authorities registering complaints about the condition of these properties.

PURPOSE: To determine whether local recreation facilities are adequate to meet the community's needs.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: Esthetic resources and recreational facilities of economic and non-economic value are becoming increasingly important in leisure-time activities.

REFERENCE: Environmental Education Curriculum Infusion Units. General Education and Curricular Services, Albany, New York (P.L. 91-516). ED 137 056.

ACTIVITY: Ask students to list the recreational activities in which they personally engage. Classify these activities as: (a) active or spectator; (b) school related or nonschool related; (c) activities that can be pursued upon completion of school. When lists are complete, rank order the activities according to participation and to the priority which students assign each. Discuss.

-How may each of the most frequently mentioned sports activities affect the health and safety of society and of the individual?

-How may each interrelate with the condition of the environment?

Survey community agencies such as local government, community centers, settlement houses, "Y's," religious centers, etc., to determine the location, size, and type of recreational facilities available in the community. Using these data, map their locations. List the recreational opportunities available, classifying them as active or passive.

Have students develop a questionnaire for the community to determine (a) involvement in each recreational pursuit; and (b) projected involvement if additional facilities were available.

COMMUNITY RECREATION SURVEY

Name: _____ Sex: M____ F____

Age Group: under 15____; 15-24____; 25-34____;
35-45____: and over____

	Time Involved Per Week	Projected Time If More Facilities Were Available
Active Recreation		
Bicycling	____ hrs.	____hrs.
Walking	____ hrs.	____hrs.
Canoeing	____ hrs.	____hrs.
Bowling	____ hrs.	____hrs.
Golfing	____ hrs.	____hrs.
Tennis	____ hrs.	____hrs.
Swimming	____ hrs.	____hrs.
Others:		
_____	____ hrs.	____hrs.
_____	____ hrs.	____hrs.
_____	____ hrs.	____hrs.
Spectator Recreation		
Films	____ hrs.	____hrs.
Libraries	____ hrs.	____hrs.
Museums	____ hrs.	____hrs.
Concerts	____ hrs.	____hrs.
Theater	____ hrs.	____hrs.
Parties	____ hrs.	____hrs.
Picnics	____ hrs.	____hrs.
Hobbies	____ hrs.	____hrs.
Radio-phono	____ hrs.	____hrs.
TV	____ hrs.	____hrs.
Others:		
_____	____ hrs.	____hrs.
_____	____ hrs.	____hrs.
_____	____ hrs.	____hrs.

Based on the community survey, discuss the following questions:

-Are there age-related differences in recreational pursuits? Classify and describe the results by age groups: under 15; 25-34; 35-46; 46 and over.

-Does the age of the participant influence the amount of time per involvement? How? Why?

-Does the sex of the participant influence the amount of time per involvement? How?

-What are the benefits of open spaces for the individual, society, and the environment?

-Are the recreational needs of the community generally being met?

-If not, what type of facility would be the most appropriate addition?

-Where in the community should it be placed?

-Is there now space or would something have to be eliminated or moved?

PURPOSE: To determine the effectiveness of zoning as a land use management tool.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: Zoning is a practice in which land uses are prescribed based upon value judgments regarding the needs of society.

REFERENCE: Junglas, Mary, et al. Environmental Learning Experiences. Socio-cultural, Junior High School. Center for Development of Environmental Curriculum, Willoughby-Eastlake City Schools, Willoughby, Ohio, 1974, p. 42, Title III, ESEA, ED 099 231.

ACTIVITY: After a preliminary introduction to the topic of zoning, have the students investigate the zoning regulations and determine the names and definitions of the various zoning categories, such as commercial, heavy industry, light industry, single family, and multi-family designations. Have the students locate on a zoning map their homes and school. Pick and appropriate area near the school and conduct a visual survey of the area. Students should be alerted to note any land use which does not conform to the zoning regulations affecting the area. If non-conforming uses are noted, the following questions could be introduced.

1. Was the property being used in the same manner before the passage of the current zoning regulations and therefore exempt?

2. Was the use of the property a result of spot zoning or had a variance been granted?

Caution should be taken not to be overly technical with respect to zoning (it is all too easy to bog down here), but to keep considerations on an elementary level, particularly with respect to the interests and abilities of the group.

PURPOSE: To determine how community land use planning influences individual life styles in the future.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: Land use management to meet the needs of successive generations demands long-range planning since options available to future generations must not be foreclosed.

REFERENCE: Junglas, Mary, et al. Environmental Learning Experiences. Socio-cultural, Junior High School. Center for the Development of Environmental Curriculum, Willoughby-Eastlake City Schools, Willoughby, Ohio, 1974, pp. 41-42, Title III, ESEA, ED 099 231.

ACTIVITY: Have students contact local government officials or the local planning agency and acquire a copy of the community's master plan and any accompanying maps as well as zoning regulations and maps. Have the students analyze and interpret the report, regulations, and maps. The teacher can lead the exercise by asking the following questions:

1. What areas of the community are destined for a different land use in the future?

2. What will happen to people and structures in existing areas that will experience land use changes?

3. Where will new expressways, bypasses, bridges, and other new roads be constructed?

4. Toward what areas is the growth of the community headed?

5. Have areas been designated for the following?
   a. New schools
   b. Libraries and other cultural sites
   c. Parks, open spaces, and recreation areas
   d. Industrial development sites
   e. Commercial shopping centers
   f. Low-income housing areas
   g. Police, fire, and other municipal service areas
   h. Mass transit facilities

6. What are the projected population statistics for the future? On what are they based?

7. What are the estimated costs for expanding existing facilities? Who will pay for these improvements? How much of the funds will come from the local, state, and federal levels?

PURPOSE: To determine the status of land use patterns in the local community.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: Land use policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.

REFERENCE: Junglas, Mary, et al. Environmental Learning Experiences. Socio-cultural, Junior High School. Center for the Development of Environmental Curriculum, Willoughby-Eastlake City Schools, Willoughby, Ohio, 1974, p. 41, Title III, ESEA, ED 099 231.

ACTIVITY: Have the students prepare a large map showing present land use patterns in the community. A completed map should contain the following:

- Major physical features
- Limits of urban settlement
- Residential areas
- Commercial areas
- Light and heavy industry areas
- Public land use areas (schools, municipal facilities, parks, etc)
- Major transportation routes and facilities

Supplemental maps or overlays may also be produced by the students, showing population density; ethnic and minority groups; high, average, and low income distribution; housing conditions; decaying commercial and residential areas, etc.

PURPOSE: To investigate the evolution of land use practices in the local community.

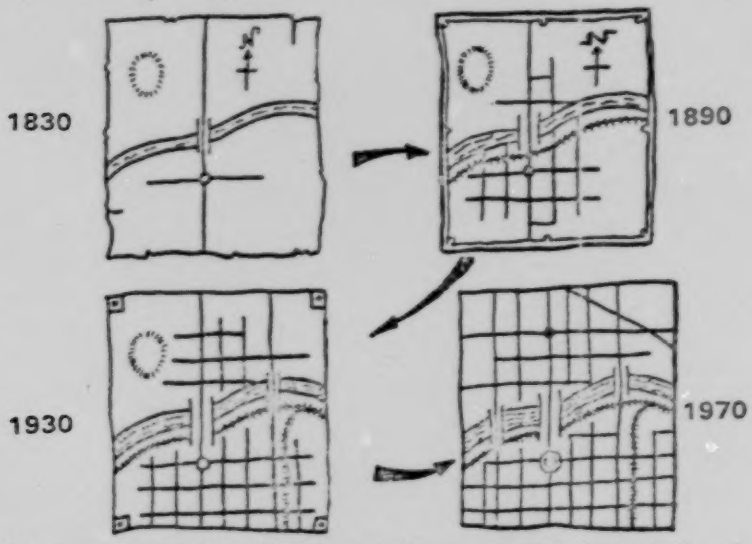
LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: Increasing population and per capita use of resources have brought changed land to man or resource to population ratios.

REFERENCE: Junglas, Mary, et al. Environmental Learning Experiences. Socio-cultural, Junior High School. Center for the Development of Environmental Curriculum, Willoughby-Eastlake City Schools, Willoughby, Ohio, 1974, Title III, ESEA, pp. 40-41. ED 099 231.

ACTIVITY: Done in detail, this activity presents the danger of being overly time-consuming, to the point where it could be treated as a separate unit in itself. The teacher must make a judgment, based on the local situation and on the values which he sees in the activity, about how far to carry it. One recommendation is to sub-divide the activity into a series of small-group activities.

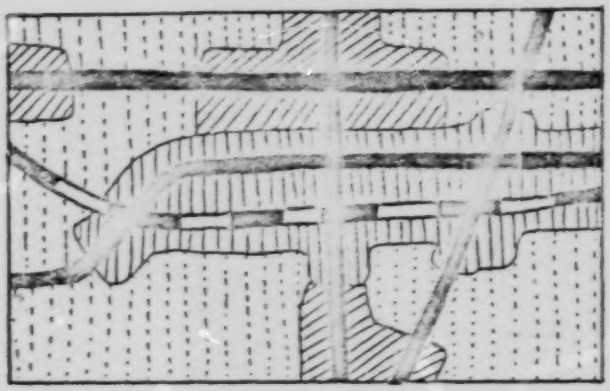


Have the students trace the growth or lack of growth of the community since its founding. It may be appropriate to select certain years (1790, 1830, 1910, 1950) and have students investigate the stage of growth at each period. Students should be encouraged to identify the major changes and factors which affected the growth of the community.

Some of the following factors may be identified:

1. discovery of new resources (minerals, oil, salt, stone, etc.)
2. development of new types of transportation and new routes (roads, canals, steamships, railroads, airplanes, etc.)
3. development of new industries
4. commercial expansion
5. natural disasters
6. war
7. development of new technology
8. expanding job opportunities

Students should also be encouraged to develop a series of maps and graphs showing the growth of the community at the various stages. Population growth, agricultural vs. non-agricultural jobs, ethnic and minority groups, transporation routes, population density, and community land use are just a few examples of types of data that can be researched.



PURPOSE: To investigate local and regional land use patterns, using the line-transect method.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: Man has developed techniques useful in describing land and its uses.

REFERENCE: Junglas, Mary, et al. Environmental Learning Experiences. Socio-cultural, Junior High School. Center for the Development of Environmental Curriculum, Willoughby-Eastlake City Schools, Willoughby, Ohio, 1974, pp. 10-11, Title III, ESEA, ED 099-231.

ACTIVITY: A line transect is an method of obtaining data about a community, usually in the ecological sense in "natural" communities. In this activity, that method is adapted as a technique for investigation of land use.

1. Using road maps, air photos, topographic maps, or any other pertinent sources, try to determine the location of various types of land uses in your area. This can encompass the diversity in one community or cover a wide variety of communities.

2. Select the communities or community to be studied.

3. Determine a route (transect) that crosses the greatest diversity of land use types. A macro-community might include a farming area, a farm town, a city satellite, a rural area, a new suburb, an old suburb, a residential area, or an affluent area. A micro-transect could include within one community the business section, residential area, industrial park, affluent residential area, new housing area, and a poor area.

4. Determine the feasibility of the route of the transect. Consider such factors as availability of sites for random sampling, traffic conditions, industrial hazards and community hostility. If any factor renders the transect infeasible, seek a solution to the problem or find a new transect route. Although the transect is the base for the sampling, allow latitude and flexibility to include close by sites for sampling.

5. Determine the sites for sampling. At some of the sites, the students may want to record only their own impressions; at other sites they may want to interview residents, merchants, workers, other students, etc. If any of the sites are on private property (i.e. a supermarket), explain to

the manager of the property what the activity is about. While sampling sites are being determined, slide photos can be taken of the sampling areas. The slides will be used to introduce the students to the activity.

6. Set the dates for the activity, and secure permission and transportation if needed.

7. Discuss with the class the objective of the activity.

8. Have the class form task groups for the sampling.

   The tasks: Eye Balling -- Recording visual impressions with cameras, video tape recorders, sketches, prose, or poetry.

   Ear Drumming -- Recording how the site sounds, using tape recorders or writing.

   Interviewing -- Recording what other people feel about the sampling sites and the environment.

   The tasks can be rotated at each sampling site.

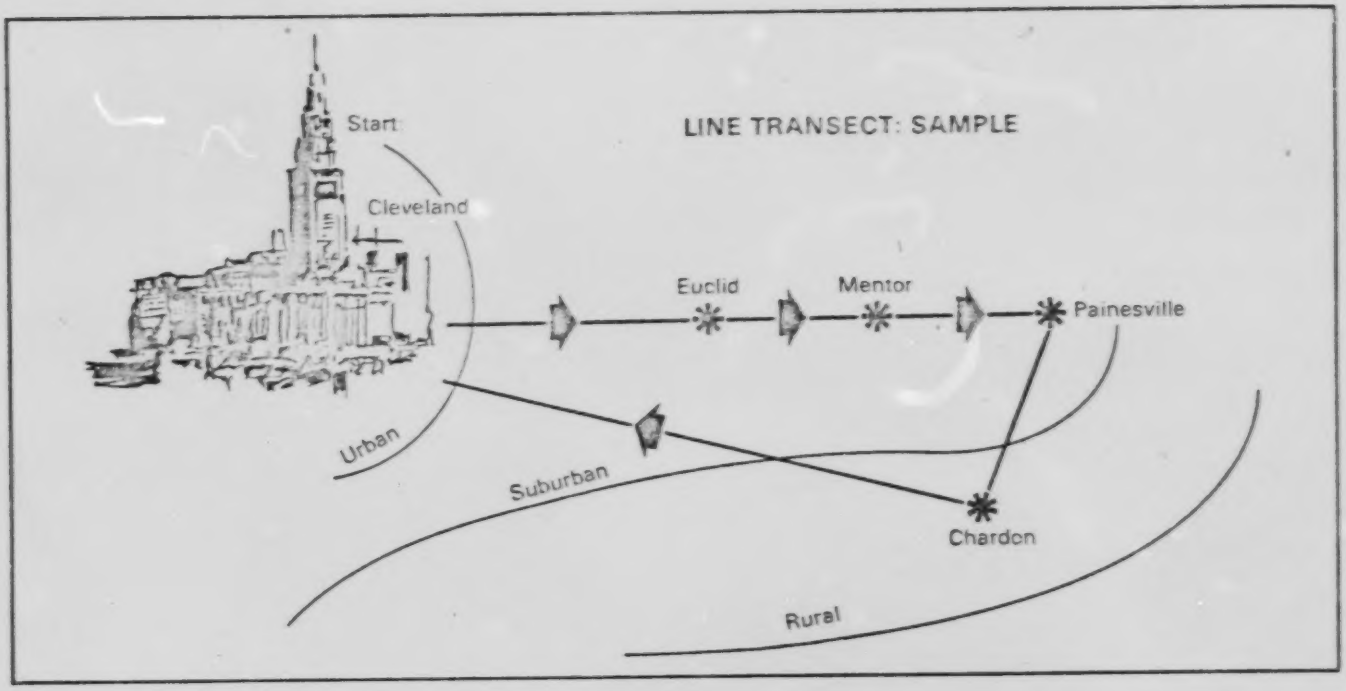
9. Develop the questionnaire to be used at each site.

10. Practice interview techniques, emphasizing not only what to ask but how to ask it. Practice your teachings and questionnaires on other students and teachers. Be sure students follow through on statements made by the person being interviewed.

11. Have the students become familiar with any equipment they will be using.

12. Conduct your line-transect and organize the information gathered. The students may want to devise a system to tabulate the interviews, looking for key words or phrases that can provide clues to the trend of the interviews. The Ear Drum and Eye Ball material could be put together into some sort of display or multi-media presentation and be shown to the class or other groups.

13. Repeat the pre-trip slide presentation. Have the students compare their before and after viewpoints of the various land uses.


LINE TRANSECT: SAMPLE
Start
Cleveland
Euclid
Mentor
Painesville
Urban
Suburban
Chardon
Rural

PURPOSE: To study a variety of concerns contained in a specific recreation area.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: Esthetic resources and recreational facilities of economic and non-economic value are becoming increasingly important in leisure-time activities.

REFERENCE: Fox, Charles E. Activities for Teaching Forest Conservation: Grades 5 through 9. Forest Service, U.S. Department of Agriculture, January 1958.

ACTIVITY: Visit a recreation area and study it from the standpoint of:

What public agency administers the area?

List the attractions of the area.

List the types of conveniences installed for comfort, safety, and sanitation.

Do conveniences appear adequate for the demand?

List the jobs that must be done each year to maintain the area in an attractive condition. (This can be a revealing list if all work, such as transplanting shrubs, spraying for insect control, etc. is included.)

Estimate the number of persons required to maintain the area (1) yearlong; (2) extra workers during the active summer season based on the list of jobs.

Assume yearly salaries and daily wages; compute the cost of maintaining this area for one year.

PURPOSE: To identify beneficial and detrimental effects of various land uses and to evaluate the compatibility of the land use areas.

LEVEL: 7-9

SUBJECT: Social Studies

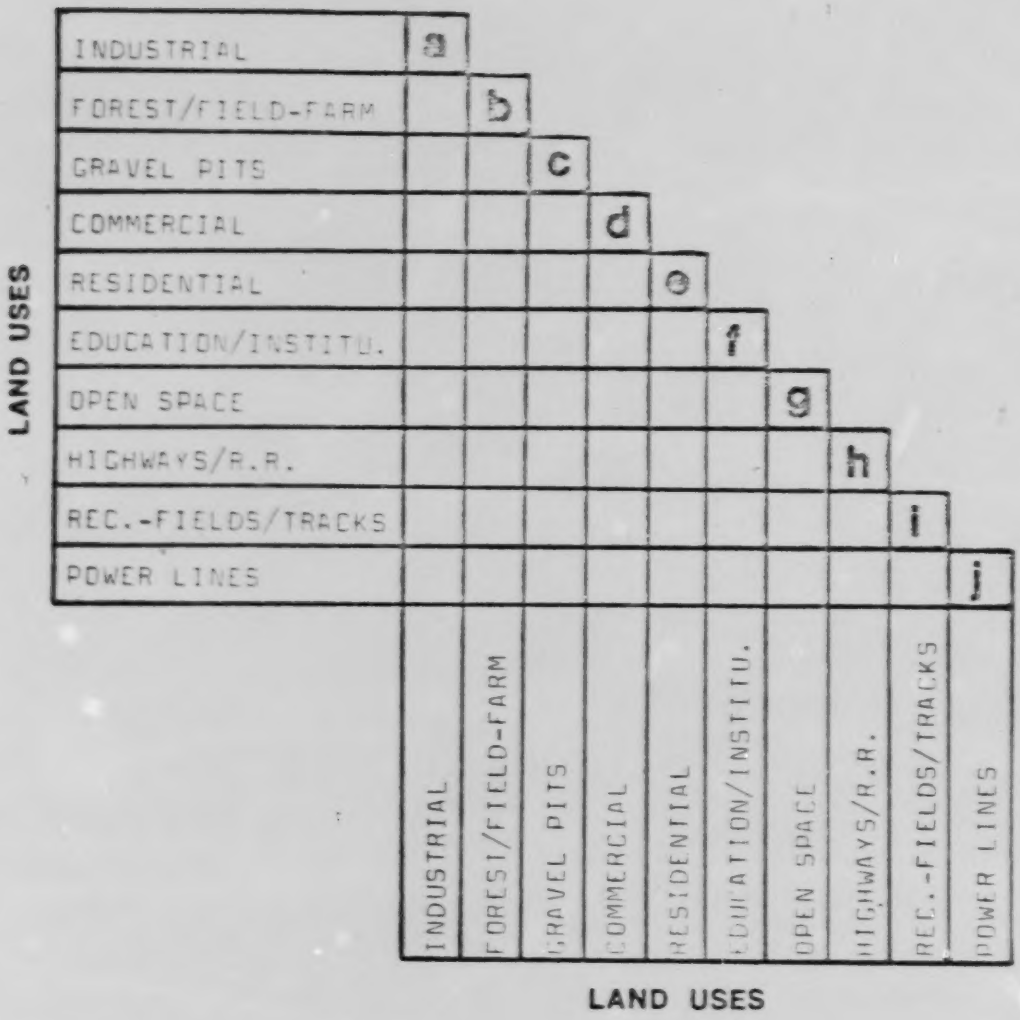
CONCEPT: Natural resources are unequally distributed with respect to land areas and political boundaries thus, conflicts emerge between private land use rights and the maintenance of environmental quality for the general public.

REFERENCE: Bennett, Dean B. & Willink, Wesley H. Junior High School Environmental Education Teacher's Guide: The Human Environment. Yarmouth, Maine School Department, 1975. Title III, ESEA. ED 121 567.

ACTIVITY: Through class discussion list the beneficial and detrimental effects on people and the environment which might be associated with each of the ten land use areas. (Note: Effects on the natural environment might relate to habitat for wildlife, soil erosion, vegetation, water and air quality, etc. Effects on people might relate to safety, durability, convenience, efficiency, usefulness, aesthetics, social relations, etc.)

Using this list, vote on the degree of compatibility of side-by-side land uses. Use the chart on the transparency to record the rating for each land use combination. This chart will help the class to make judgments on the compatibility of land uses in an orderly way. (See Figure 1 for transparency master.)

FIGURE 1



LAND USE COMPATIBILITY RATINGS

LEGEND

Good Combination = 3

Neither Good nor Bad Combination = 2

Bad Combination = 1

To use the chart, start by comparing industrial (at the bottom of column 'a') with each of the other land uses listed up and down along the left side of the chart. Going up from the bottom, compare industrial with power lines, first. If industrial areas and power lines make a good combination place a '3' in the box.

If there are no serious objections (neither particularly good nor bad) give it a '2'. If it is a bad combination, give it a '1'. Make the decision and rating after considering the beneficial and detrimental effects listed in Part A.

Going up the list next, compare industrial with Recreation-Fields/Tracks. Continue until industrial at the top of the list is reached. There is no box here since the same uses cannot be compared.

Continue until all land uses along the bottom of the chart have been rated with uses listed on the side.

To find out which uses are most compatible with all other uses, add the scores in column 'a' upward to the last box in the column. For columns 'b' through 'i', not only add the numbers in the columns but add all numbers in the horizontal row to the left of the top shaded box to the score. For column 'j' add all the scores across in the bottom horizontal row. Rank order the land uses according to the scores; the land use with the highest is most compatible with all other uses. The land use with the lowest score presents the most problems. What does this mean to planners?

Obtain an aereal photograph of your community. Using the numbers in the completed chart, label all the "bad combinations" by drawing a circle around each bad combination area. (This may be demonstrated by the teacher on an overhead transparency.)

PURPOSE: To trace zoning legislation in your school community and determine its effects.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: Zoning is a practice in which land uses are prescribed based upon value judgments regarding the needs of society.

ACTIVITY: Contact your city manager's office and ask for the history of and current zoning regulations in your local area. Give each student a map of the area surrounding the school. Divide the class into groups and assign each group a portion. Have each group outline its area on the individual maps. Using historical resources such as long-time residents and the historical information provided by the city manager, ask each group to sketch on one map how their area must have looked during the first decade the area became populated. On another map(s) have the groups identify city ordinances related to zoning and resulting changes in their area. Based on the information gained from the previous maps and current land uses, ask the class to make predictions about the direction of future legislation and sketch on another map the way the area might look in the future. Have each group report their work to the rest of the class. Check for similarities and inconsistencies among groups. As a culminating activity, the class could draw a series of mini-murals to demonstrate advances in land use practices.

PURPOSE: To learn how land use patterns in the local community change.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: Social and technological changes alter the interrelationships, importance, and uses for land.

REFERENCE: Junglas, Mary, et al. Environmental Learning Experiences, Socio-Cultural, Senior High School. Willoughby-Eastlake City Schools, pp. 42-44, Title III, ESEA, ED 099 232.

ACTIVITY: Changing land use patterns within the local community often provide an appropriate topic of study, and are particularly useful in developing students' understandings of land use planning concepts and problems.

Have students investigate shifting patterns of land use within the local community over time. An appropriate approach is through mapping exercises, whereby students make their own maps based on available historical data of their own community, showing changes with time. The intention here is not for a topographic mapping exercise, but a street/building/business area/ industry/ housing/recreation/ open space/agriculture series of maps, showing changes over time. It may be appropriate also to include increases in suburbanization. One approach might be to use twenty-year time interval maps, making use of data available from local historical societies, planning agencies, county or city office buildings, and the like.

A useful supplement, or alternative, to this activity would be the preparation of a series of wall or bulletin board displays of maps and accompanying photographs and/or drawings keyed to the maps, indicating how land use within the community, and the community itself, have changed.

Secure an aerial photograph of the community, perhaps from city hall, a local planning agency, or other source (see Appendix C for possible sources). Such photos are normally available at small cost. Use the photograph to make such maps as may be needed or useful for various activities related to land use studies, such as those discussed above. Use the aerial photograph as a bulletin board. Use it to locate, by means of map tacks, features of particular interest or concern.

A few representative study activities are discussed below:

1. How is land within the community currently used? Use a community map to determine locations and extent of park and recreation areas within and near the community; determine what segments of the community are served by each park,

what facilities are available in each park, and what use patterns are evident.

2. Make a community map showing legal zoning patterns; mark any variances on it. Find out why these variances were granted (such information comes from city hall and the county clerk's office). Also find out why zoning was instituted in the first place. Find out what the zoning laws are in the community, why they were established as they were, how they have been changed, and what additional changes may be projected. Also find out how variances may be secured.

PURPOSE: To identify the negative effects of lack of zoning.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: Zoning is a practice in which land uses are prescribed based upon value judgments regarding the needs of society.

REFERENCE: Junglas, Mary, et al. Environmental Learning Experiences, Socio-cultural, Junior High School. Center for the Development of Environmental Curriculum, Willoughby-Eastlake City Schools, Willoughby, Ohio, 1974, p. 42. Title III, ESEA. ED 099 231.

ACTIVITY: Identify one or more areas within the community whose growth and development suffered from the lack of effective zoning regulations. Have the students discuss and determine the undesirable aspects of the development of these areas. What zoning regulations would have been necessary to prevent the present conditions? What can be done to correct the situation at the present time? What better types of land use could the area be utilized for? Are private groups or governmental agencies concerned about these areas? What proposals have been made to improve the situation? How could these areas be improved by private developments, the Public Housing Authority, urban renewal projects, beautification projects, public condemnation, and conversion of the area into parks, open spaces, recreation areas, etc.?

PURPOSE: To identify the geographical factors encouraging development of human settlements.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: Physical characteristics of the natural environment are of major importance in determining land use.

REFERENCE: An Environmental Syllabus: Grades 10, 11, 12. New York State Education Department, pp. 86-87. SE 022 615.

ACTIVITY: Why people settle in the places they do is basically decided by an array of geographical factors, not the least of which is land capability.

Develop a list of geographical factors which influenced the location of early American settlements, and the lifestyles and occupations of settlers in early American settlements, and the lifestyles and occupations of settlers in early American history. Consider specific regions and areas whose development reflects these factors (e.g., New York City, Boston, New Orleans, San Francisco, Cleveland, Chicago, St. Louis, etc.)

Consider questions such as these:

1. Do today's population density figures continue to evidence these early settlement patterns? Explain with specifics.

2. What specific factors cause changes in settlement patterns, once initial settlement has occurred?

Probably the most effective way to make the point of this activity is to apply the question to the local community. Several of the activities in this volume relate to such studies. However, it is appropriate to consider these questions in relation to several specific cases in addition to the local community, so that there is appropriate basis for generalization.

PURPOSE: To develop an understanding of the land use implications of development of transportation systems.

LEVEL: 7-9

SUBJECT: Social Studies

CONCEPT: Increasing population and per capita use of resources have brought changed land to man or resource to population ratios.

ACTIVITY: A major determinant of changes in land use patterns in the United States, and elsewhere, has been the development of transportation systems. The truth of this statement is readily verified through considerations of the effects of the automobile and highway systems on land use in general, and on settlement patterns in particular.

One expression of such patterns is the emergence of commercial strip development along main streets and highways, often accompanied by zoning changes to legalize such development in areas which were previously residential or rural. Many cities evidence the development of commercial and industrial centers outside their historic "downtown" and/or industrial areas, utilizing the convenience of arterial highways, outerbelts, etc., to facilitate such development.

In many communities, the most obvious expression of the influence of highway systems is in the development of suburban housing patterns, wherein land that was previously rural (perhaps agricultural, perhaps "unused") is converted into residential tracts, primarily for those who can afford them.

Students should look for local examples of the types of development mentioned above and consider implications, such as:

1) What has happened to business, industry, and housing in the inner city as a result of outward movement?

2) How have land uses changed in areas developed outside the central city?

3) What evidences are there of "good" or "poor" land use planning in connection with such development?

4) What local environmental problems may be traced, or related, to commercial, industrial, or residential development of areas outside the central city?

5) How have these shifts created or accentuated environmental problems in the central city?

6) What are the energy implications of relying on highway transportation between inner and outer cities?

7) As our energy supplies become increasingly scarce, what possible alternatives might we face with respect to urban-suburban sprawl?

8) Develop a scenario as to the possible effects of critical shortages of energy for private transportation on local communities.

PURPOSE: To measure land areas in acres.

LEVEL: 7-9

SUBJECT: Mathematics
Science
Social Studies

CONCEPT: Man has developed techniques useful in describing land and its uses.

REFERENCE: Junglas, Mary, et al. Environmental Learning Experiences. Bio-Physical, Junior High School. Center for the Development of Environmental Curriculum, Willoughby-Eastlake City Schools, Willoughby, Ohio, 1974, pp. 44-45, Title III, ESEA, ED 099 229.

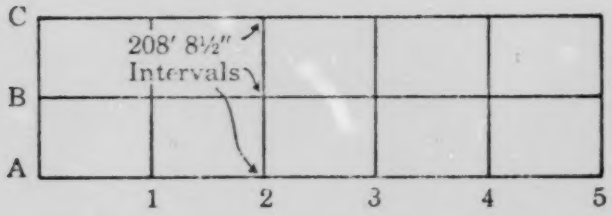
ACTIVITY: Methods of land measurement are many and varied. In the United States, a traditional and useful unit for measurement of land area is the acre. This activity delineates one method of measuring acres which may be usefully employed by junior high school students particularly in non-urban settings.

An acre may be plotted by measuring out a square of 208 feet, 8 1/2 inches on each side. Locate your base line from the farthest point that will allow you to closely investigate a specific area. Mark this point well and as permanently as possible, so that students can become proficient in plotting an acre.

Once you have your starting point, run a straight compass line and mark off 208' intervals. In good terrain, the intervals can be paced, but measuring by steel tape or rope is more accurate. In thick cover send a man ahead with a colored stake and keep him on the line through the compass sights as long as you can see his stake. When he has driven in the stake, move up to it and send him on ahead again. In some places, you may have to sight his stake as he holds it over his head or sight below the intervening shrubbery by lying on the ground yourself.

If the cover is dense and brushy, it may be necessary to cut a narrow sighting land through it.

When the first 208' interval has been measured, put in a stake, mark a tree or otherwise fix this, your second corner. Keep marking the intervals until you come to the boundary opposite the one on which you started or until you have gone as far in that direction as you wish your grid to extend. Then run similar lines out at right angles at each of your 208' corners, and your grid is established.



This representative grid would cover 10 acres. The grid lines may be inked in. All other lines or field notes are pencil notations. An acre is a convenient area to use in a rural community, but not in an urban or suburban community, although this method of developing a grid may be valuable whether the area in concern is large or small.

PURPOSE: To investigate soil profiles, relating them to land capability.

LEVEL: 7-9

SUBJECT: Science
Social Studies
Language Arts
Fine and Graphic Arts

CONCEPT: Maintaining, improving, and in some cases restoring soil productivity is important to the welfare of people.

REFERENCE: A Handbook of Environmental Encounters. Oregon Department of Education, Instruction Division, pp. 25-28. ED 113 151.

ACTIVITY 1 STUDYING A SOIL PROFILE

Locate or dig a soil pit on or near the school grounds. Identify the three soil horizons or layers. Usually a pit may be prepared by digging a hole approximately 2½ feet deep (the depth is determined by each soil horizon). Enlarge the pit in width and length to accommodate the investigating team.

After a soil pit has been prepared, have each student take a handful of soil and describe it in as many ways as he can, involving as many senses as possible. Discuss with students their soil descriptions and formulate a working definition of soil, either in written or oral form.

Using the soil pit as the study area, ask each student to look at it for three or four minutes and then write down all the things he observes. Share these observations with the group and compare them. The following questions are designed to aid in the analysis:

What color differences were seen?

How did the soil look at the three levels?

Why isn't the soil the same at each level?

How far down do plant roots go?

What happens to the humus level?

ACTIVITY 2 RECORDING DATA

At the soil pit divide the students into small work teams and have each record the depth of every horizon. This is done by measuring the distance of each layer with a tape measure, ruler or yardstick. Have each team determine and record the color of every layer. Have students feel the soil to determine the texture, and record it according to classification—sand, silt, or clay. As the soil breaks apart, ask if it is *platey, blocky, granular* or *columnar*. Platey soil breaks into flat sections like slate; blocky soil breaks into chunks; granular soil comes apart in small particles like gravel; columnar soil breaks into vertical sections.

Have each student collect a specimen from every soil horizon. Fill a jelly cup with soil, stapling the lid (a piece of cardboard 3 inches by 7 inches) on the cup; place it upside down, marking the horizons A, B and C. Soil samples may be wrapped in plastic wrap, labeled and glued onto cardboard if jelly cups are not available. This display is called a micromonolith. What does the soil color indicate? Why is it important to know the texture of the soil? What does the depth of each horizon tell the observer?

ACTIVITY 3 RECORDING DATA

1. Using a metal-tipped thermometer, have each team record the air temperature and then predict if the soil temperature will be cooler or warmer, and why. Have each group note the temperature of the three horizons, and record each on the chart. Compare the results verbally and discuss why temperatures vary in the soil. Why is it important to know the soil temperature?

2. With a soil pH kit, have each team test the soil for acidity or alkalinity and compare the results for each horizon. Follow the directions given in the kit and use the color comparison chart to check if the soil tends to be acid or alkaline. Record the information on the chart. What can be done to a soil that is too acid or too alkaline?

What plants like to live in acid or alkaline soil? How can you tell?

Appraisal — Using the charts (pp. 135-137), have each student interpret the data he gathered from the study of soil horizons. The interpretation should be written and then discussed and compared with others in the class. Such questions as the following might be asked:

How do texture and structure affect the movement of water and air through the soil?

Do you think the soil is fertile? Why?

CURRICULUM RELATIONSHIPS

Social Studies — Investigate the problem of soil conservation in the state, or in your county. Information may be obtained from the county extension agent. What are the effects of soil erosion? How is soil erosion created? What does the federal government offer in the way of aid to farmers to combat soil erosion? Contact the State Department of Agriculture if you need more information.

Science — Find out what means scientists have developed to balance soils too acid or too alkaline. Develop an experiment to demonstrate the effects of soil pH on plant life.

Language Arts — Write a few paragraphs about the importance of soil to human and animal life. Express the meaning of soil to you in a poem. Personification might prove interesting.

Fine and Graphic Arts — Draw a diagram of the soil, using crayon. Match texture and structure, if possible.

(1) Information on Soil Profile

Sketch your soil profile, label the horizons and record the data.

PROFILE SKETCH

DATA

Contents of Duff:_____

_____, Depth_____" to _____"

A. Horizon

Topsoil: Depth_____" to _____" Color_____

Texture: Sand_____, Silt_____, Clay _____

Structure: Columns_____, Blocky_____,

Platey_____, Granules_____

pH_____, Temp._____°F, Plant Roots_____

B. Horizon

Subsoil: Depth_____" to _____" Color_____

Texture: Sand_____, Silt_____, Clay_____

Structure: Columns_____, Blocky_____,

Platey_____, Granules_____

pH_____, Temp._____°F, Plant Roots_____

C. Horizon

Parent: Depth_____" to _____", Color_____

Material

Texture: Sand_____, Silt_____, Clay_____

Structure: Columns_____, Blocky_____

Platey_____, Granules_____

pH_____, Temp._____°F, Plant Roots_____

Type of rock in the bedrock:_____

(2) Analyzing Soil Data

The following information will help you interpret the data collected from the soil profile and enable you to answer the questions in Section 2.

A. Effects of soil depth on plant growth and water storage.

Deep (42" and over)—excellent plant growth and water storage.

Moderately deep (20"-42")—good plant growth and water storage.

Shallow (20" and under)—poor plant growth and water storage.

B. Effects of color on soil (use Munsell Color Chart)

Soil Surface Color A Horizon	Amount of Organic Material	Erosion Factor	Aeration	Available Nitrogen	Fertility
Dark (dark grey, greyish; brown to black)	Excellent	Low	Excellent	Excellent	Excellent
Moderately Dark (dark grey, dark brown; to dark yellow-brown)	Good	Medium	Good	Good	Good
Light (pale brown, yellow; brown to yellow)	Low	High	Low	Low	Low

Subsurface Soil Color (8 Horizon)	Condition
Dull Grey (low rainfall soils)	Water-logged soils, poor aeration
Yellow, red-brown, black (forest soils)	Well drained soils
Mottled grey, brown or yellow (humid soils)	Somewhat poorly drained soils

(3) Effects of Soil Texture

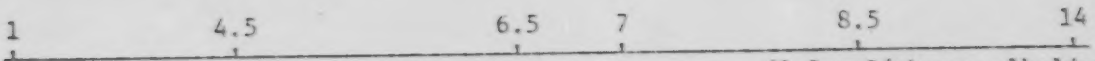
	Water-holding capacity	Looseness
Sand	Poor	Good
Silt	Best	Good
Clay	High	Poor
	(low availability to plants)	

(4) Effects of Soil Structure

Type	Penetration of Water	Drainage	Aeration
columns	good	good vertical	good
blocky	good	moderate	moderate
granular	good	best	best
platey (low rainfall soils)	moderate	moderate	moderate

(5) Effects of pH on Soil

Plants need many food elements in order to grow well. These include nitrogen, phosphorus, potash and sulphur. The amount of pH determines how readily plants can get these elements.



(1 to 4.5 is too acid for most plants)

(Most plants do best here)

(8.5 to 14 is too alkaline for most plants)

Example of plants in pH range:

pH 4.0-5.0: rhododendrons, camellias, azaleas, blueberries, fern
pH 5.0-6.0: pines, firs, holly, daphne, spruce, oaks, birch, willow
pH 6.0-7.0: maple, mountain ash, pansies, asters, peaches, carrotts, lettuce
pH 7.0-8.0: beech, mock orange, asparagus

(6) Effects of Temperature on Plant Growth

Plants do not grow well when the soil is too cold or hot during the growing season. The following chart applies to most of the soil temperature zones.

Soil Temperature	Growing Conditions
Less than 40°F	No growth, soil bacteria and fungi not very active
40°F to 65°F	Some growth
65°F to 70°F	Fastest growth
70°F to 85°F	Some growth
Above 85°F	No growth

PURPOSE: To design and build a "Model City of the Future".

LEVEL: 7-9

SUBJECT: Social Studies
Science
Math
Industrial Arts

CONCEPT: Land use policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.

REFERENCE: Junglas, Mary R. & others. Environmental Learning Experiences: Bio-Physical: Junior High School, Center for the Development of Environmental Curriculum, Willoughby-Eastlake Schools, 1974, Title III, ESEA. ED 099 229.

MATERIALS: Scrap tin cans, egg cartons, milk cartons, straws, toothpicks, popsicle sticks, cottage cheese and sour cream containers, paper, glue and paint, styrofoam used for packing fragile items, throw-away flower pots.

Note: Suggestions for city so that teacher may give explanations.

ACTIVITY: Suggest to your class that they design and build a model City of the Future according to the following criteria:

1. Dwellings will probably have to be high-rise apartments. On the roofs put recreation areas, green houses, swimming pools, and tennis courts. Use bicycles for individual transportation and bicycle paths. You must have grass

ard trees and very little concrete. Water runs off concrete. Without grass and trees there is no absorption of carbon dioxide or generation of oxygen. Provide electric vehicles, a mono-rail system, a subway system for transportation, and a travel center outside the city to rent cars, boats, motorcycles, recreational vehicles or to take a plane. Provide areas for each person to do personal gardening.

2. Building the City

Students make all the parts of the city as individual units. Do not try to put them all on a base. They usually turn out too big to do this. Set up the whole city on as large a space as is available. Then examine, criticize, and complement it.

3. Criteria for the Site

Select a site for a city of 1/2 million people, large enough to be able to provide government, cultural, recreational, and educational services, but not too big to be unwieldy. Select a climate conducive to human comfort, one which provides raw materials available for heavy industry and a location at least 100 miles from any other metropolitan area. Remember to find a means of generating electricity and/or other power sources available. Existing transportation should be nearby, as should recreation facilities for outside recreation which needs large spaces, such as boating and skiing. A water supply should be available. The city must be contained within 100 square kilometers.

4. All specifications must be written in metric units.

Specifications must include the following:

Housing allotment (size and types of homes)

How people are grouped (age, interests, family?)

Where everything is located in the city according to the most efficient plan

Distances between things in the city

Amounts of waste water which will be produced

Building materials which are available on or near site

Exact location of the city (latitude and longitude)

Climate of the location; waterways and mountains nearby; elevations

5. Model City of the Future must include the following features:

-Heavy density for dwellings, high convenience transportation

-Large amounts of open spaces within boundaries

-Many parks and plantings (plantings to suit location of site)

-Selection of major industries and subsidiary industries to fit site

-A means of transporting the required materials if they are not available

-No streets; only walking paths and small vehicle paths in concrete

-Some type of futuristic transportation system which is convenient

-No internal combustion engines for transportation within the city

-Buildings which are made of materials which suit the site

-Water supply—unpolluted; sewage disposal plant; solid waste use; recycling or disposal means

-Governmental agencies; fire control, government, law enforcement

-Occupations to employ at least one-third of the population

-Cultural areas; recreation areas; hotels for visitors; restaurants

-Elementary; high school; middle school; college educational plan (describe the educational system and the locations)

-Libraries and other learning centers for those not in school

-Shopping areas convenient to homes, larger central shopping area (consider computer shopping)

-Computer system

-Individual garden areas, patio and/or outdoor areas for all

-Parking area on outskirts of city for visitors

-Travel center to use in leaving city or returning

-Outside—large space—recreation areas

-Communications system within city; outside of city

-Energy sources for heat, light, to be futuristic if possible

As a class, examine Atlases to choose the site for the city.

Now divide class into groups to research the following specific topics: transportation, water supply including sewage disposal, housing, cultural areas, energy, industry and open spaces and recreation. Each group will be responsible to write up the specification on their particular topic.

The following resources may be of help for this portion of the project:

a. Division of Housing and Urban Development (HUD), Washington, D.C. Request information and statistics on present programs on city planning, development, and rejuvenation.

b. Environmental Protection Association (EPA), Rockville, Maryland. Request information about control of ecological problems.

c. NASA, Lewis Research Center, Brookpark Road, Cleveland, Ohio. Request information on technological utilization.

d. Chamber of Commerce, Reston, Virginia. Request information about their modern transit system to Washington, D.C.

e. Mayor of the City, Chicago, Illinois. Request information about new apartment buildings above switching station of Illinois Central Railroad.

f. I.B.M. Public Relations Department, Utica, New York. Request student kits on how a computer works.

g. NASA, Lewis Research Center, Brookpark Road, Cleveland, Ohio. Request information or booklet on computer programming of software.

After the topics have been researched, help the students draw a plan for their city on a large sheet of white paper, include everything that will be in the city, and color key the drawing to be sure that they know what each item is. Use metric units for distances.

Students can now build parts of the city separately and paint or color them if necessary. Use only throwaway items to build the city; no commercial items are permitted (e.g., those little houses and trees that are used in model railroad layouts).

PURPOSE: To construct simple topographic maps.

LEVEL: 7-9

SUBJECT: Science
Social Studies
Mathematics
Industrial Arts

CONCEPT: Man has developed techniques useful in describing land and its uses.

ACTIVITY: It should be apparent that, in order to consider land use, it is appropriate to master basic techniques of land description. None is more basic than the simple topographic map. Students will better understand maps after they have had experience in making them.

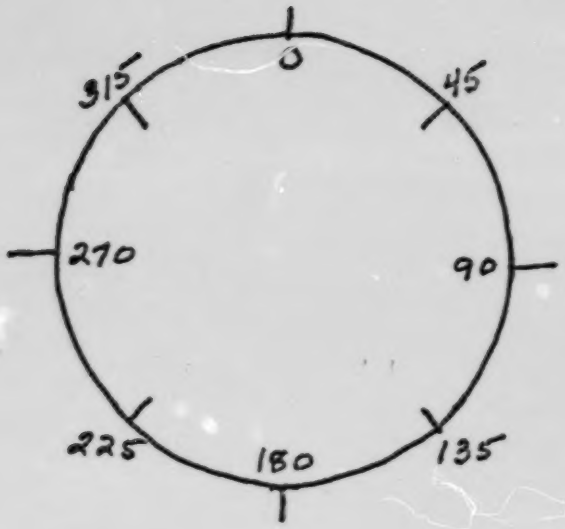
Field mapping exercises may be as simple or complex as a teacher wishes to make them, in keeping with course objectives, teacher objectives, and student abilities and/or objectives. The description here calls for a relatively advanced mapping activity, using the "metes and bounds" system as a model, but it is readily modified for less complex objectives and/or for younger or less able students.

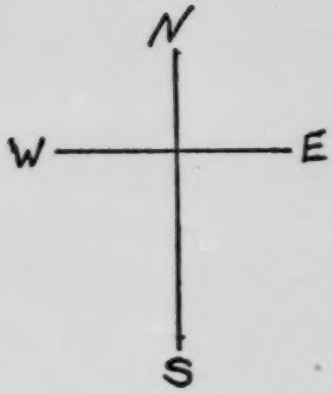
A map is nothing more than a representation of some segment of the earth's surface, or of something on that surface. Three basic elements are involved in developing such a representation; all must be measured in some way if a "complete" map is to be made. They are: direction, distance and elevation. It is possible, and in many cases desirable, to eliminate from consideration the elevation parameter and deal strictly with direction and distance.

1. Measurement of direction—the compass

The most meaningful way to determine direction is by use of a compass—as a matter of fact, it's the only way that is workable in a school setting. Brunton compasses are not needed; the Boy Scout variety is more than sufficient, as is any other that is marked off in degrees and is not broken.

Depending on student background, it will probably be necessary to spend some time on how to read a compass. One is diagrammed below for your reference. Students should make all readings in degrees, from their current position to the next position of interest. If they can read compass direction to within two degrees, they will do well enough—there is no point in agonizing over more precise readings.



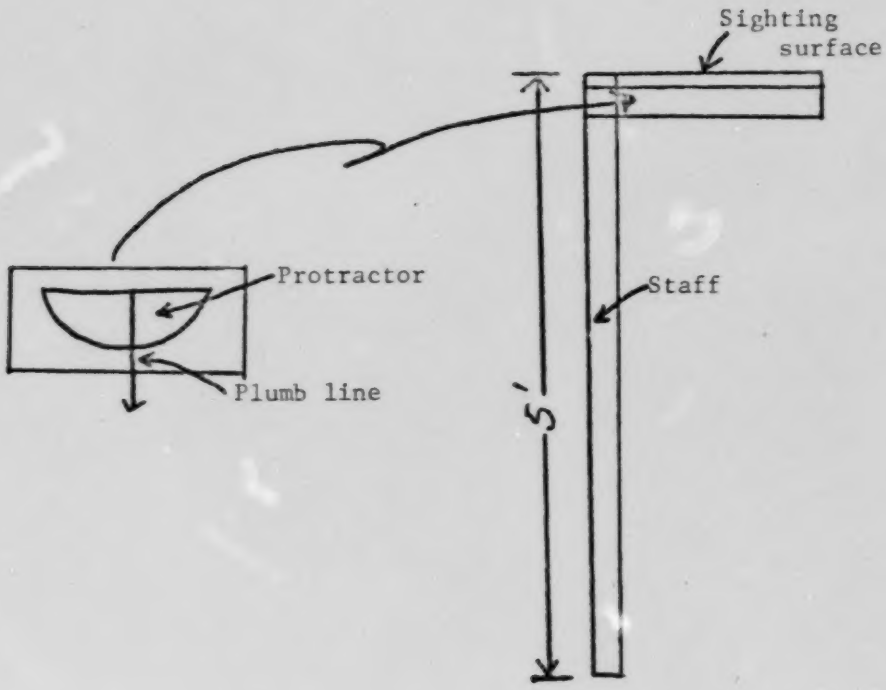


2. Measurement of distance—pace

The easiest way, and in most school situations the most meaningful way, to determine distance is by pacing. Each student should determine the length of his own pace by walking in a normal (not exaggerated) stride in a measured distance such as 100 feet, then computing his normal walking pace in feet per stride. If a student takes 30 paces to walk 100 feet, his pace is 3.3 feet per stride (100 feet divided by 30 paces). Once a student knows this, he can determine a distance on the earth's surface by counting the number of paces from one point to another, then multiplying the number of paces by the number of feet per stride.

3. Measurement of elevation—Jacob staff

A simple device for measuring elevation, actually a rudimentary "Jacob staff," may be made as an industrial arts project or at home. Needed are a length of 1" x 2" or 2" x 4" lumber, a protractor, and a simple plumb line (see below).



Procedures

There are a number of alternative procedures which may be used in developing a mapping activity. The procedure below is one which works.

After orientation concerning the use of the compass and determination of pace, students should be given an opportunity to make simple, "flat" maps of an area (perhaps the school yard). A simple technique is to assign them in pairs an area to map. Begin at (practically) any point, but one which can be easily relocated, and develop a perimeter measurement. This may be accomplished by sighting along one edge of the area to be mapped, noting the compass direction along that line and measuring the distance to a specific point in paces. From the new point, a second "edge" is measured, etc. Notes should be kept in a field notebook, vis:

From Station	To Station	Direction	Distance (Paces)	(Feet)
1--Large oak	2--Bird feeder	105°	52	172
2	3--Small fir	200°	78	257

Students progress from one "station" to the next, describing a perimeter, until they return to their original starting point. When the perimeter is completed, they may make traverses across the enclosed area from any of the identified stations around the perimeter, again measuring direction and distance, and noting points of interest.

No map is made until students return to the classroom, or wherever they have a flat surface on which to work. Then a scale is determined (by the students or, if necessary, by the teacher), distances are re-computed into inches, and protractors are used for angle measurements.

A number of "crises" develop here:

1) If the teacher does not furnish a scale, students may (will) make a number of false starts until they finally come up with a scale that works. How much frustration the teacher wishes to allow, encourage, or tolerate depends on both teacher and students, as well as objectives of the activity.

2) Compasses read up to 360°; protractors generally go only to 180°. Also, protractors must be re-oriented constantly. How much help the teacher wishes to give here is another open point.

3) Invariably (even with professionals), maps made in this fashion do not "close." How to deal with lack of closure presents another problem. Suggested here is distribution of error across a number of points rather than remeasuring, assuming that no gross errors are noted.

4) No matter how detailed the measurements, it will be necessary to "eyeball" in some detail—for example, the location of a path, the margins of a pond, etc.

With many students or groups, this may be as far as one might wish to go. However, if there is reason to introduce contour lines:

Students, working in teams of about four, utilize the same general procedures as for the "flat" map but use the "Jacob staff" to determine elevations relative to some base point. If the staff is 5 feet high, a 5-foot contour interval is obviously practical. Students then determine direction, distance, and 5-foot changes in elevation from one station to the next.

CAUTIONS:

1) It becomes necessary—at the very least, advisable —to choose stations with 5-foot changes in elevation.

2) Going uphill is a lot easier than going downhill (think about that!) but there is no way to avoid going both up and down hill without changing the basic parameters of the exercise. Ingenious students (or teachers) may discover a way to go only uphill, but students capable of doing that probably will be able to determine mapping procedures for downhill without undue problems.

Again, the map itself is made indoors. The more stations described the better, but also the more complex. When completing maps, students must construct contour lines, using information provided by their field notes; a good deal of interpolation is necessary.

The mapping activity, if carried to the point of considering elevations, is quite a complex activity and may well result in frustration for all. However, there is little excuse for not trying it with junior-senior high students unless (1) it does not "fit" with course or program objectives, or (2) the teacher is chicken. A teacher who has not tried it himself is well-advised to be chicken.

Any, or all, of the above may be embellished upon by consideration of map coloring, labeling, etc. What to do with respect to such embellishments again comes back to course/teacher/student/objectives.

LAND USE MANAGEMENT
ACTIVITIES
FOR THE CLASSROOM

Grades 10-12

PURPOSE: To study the effects of unbanization on runoff rates of storm waters.

LEVEL: 10-12

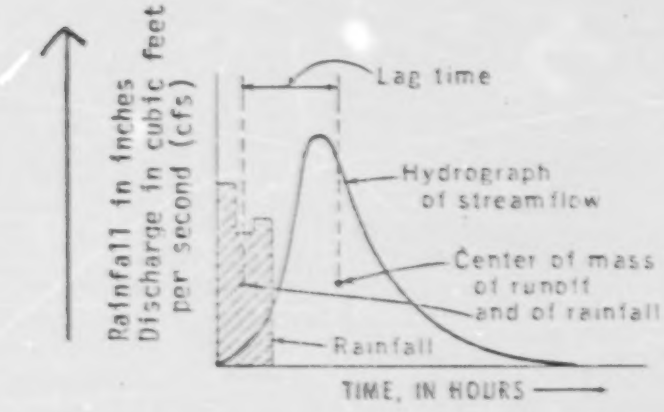
SUBJECT: Science

CONCEPT: Physical characteristics of the natural environment are of major importance in determining land use.

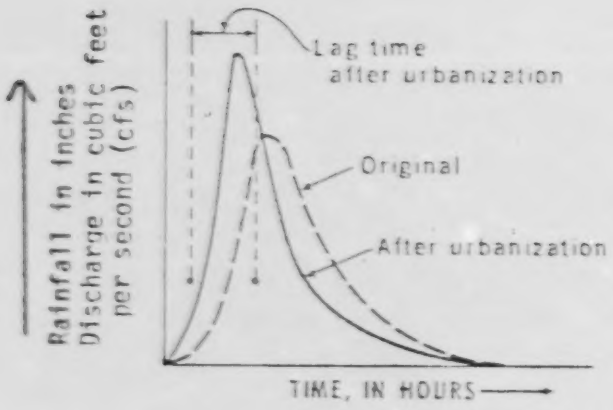
REFERENCE: Schaefer, Larry and others, Hydrosystems and Land Use Decision Making, Area Cooperative Educational Services, New Haven, CT, Environmental Education Center, 1975. ED 133 218.

ACTIVITY: In many localities, urbanization has created or accentuated flooding problems which have negative influences on land use. The following information may be useful in application to conditions within the local community.

EFFECTS OF URBANIZATION ON RUNOFF RATE



The change in flow rate at any point on a channel can be shown by a hydrograph such as the one above. The graph plots the rate of flow or discharge in cfs (cubic feet per second) against units of time. The shape of this curve will vary with steep slopes, impervious soils, and a pear or funnel shaped basin will lead to a sharper rise and fall in water level as well as a higher peak than flow from a basin with gentle slopes, porous soils, many wetlands and long narrow shape. The flow rate is also affected by man's use of the land.



Lag time (the time between the storm and peak runoff) may be materially altered by the effects of urbanization in a watershed. Water runs off faster from streets and roofs than from natural vegetated areas. This tends to decrease the lag time. The construction of artificial channels, especially storm sewers, also decreases lag time. As the time required for a given amount of water to runoff shortens, the peak rate of runoff (flood peak) increase.

A study* by Luna B. Leopold, the U.S. Geological Survey, indicated that if 50% of a basin area is made impervious through development, and 50% is sewered, a given flood will be 2.7 times more severe and will occur almost four times as often.

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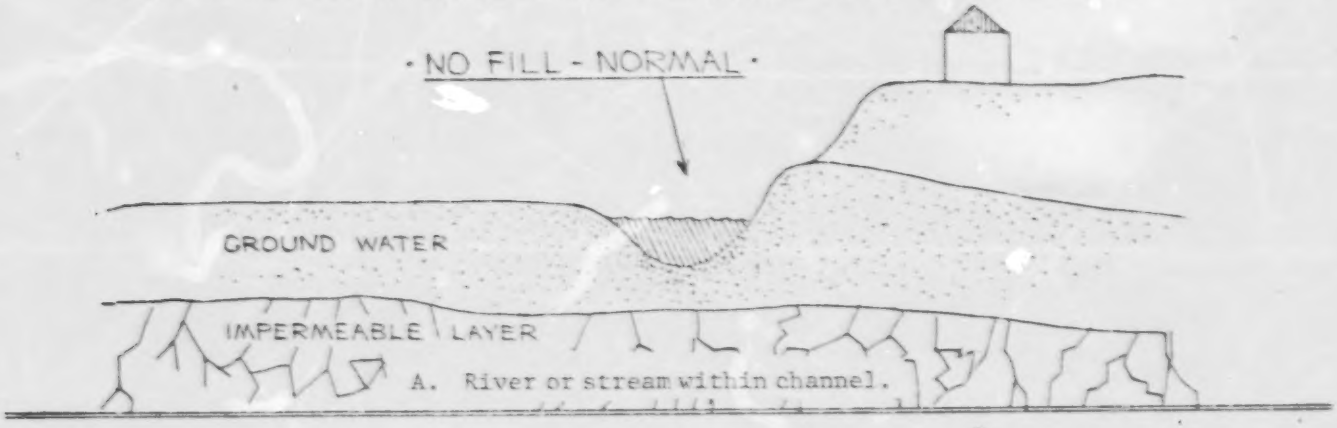
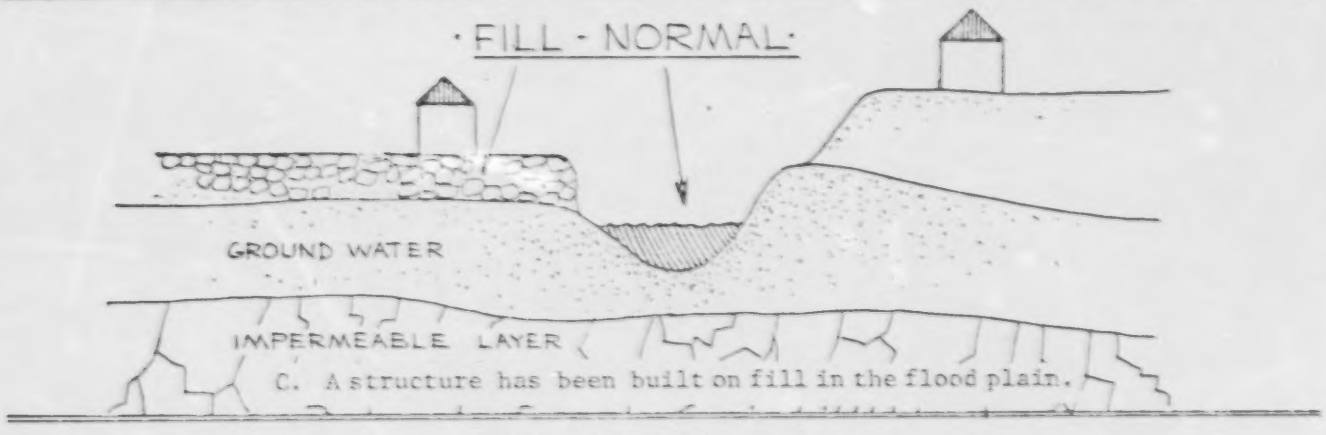
*Hydrology for Urban Land Planning: A Guidebook on the Hydrologic Effects of Land Use by Luna B. Leopold. Geological Survey Circular #554.

EFFECT OF DEVELOPMENT ON THE CAPACITY OF A FLOOD PLAIN TO ABSORB FLOODS

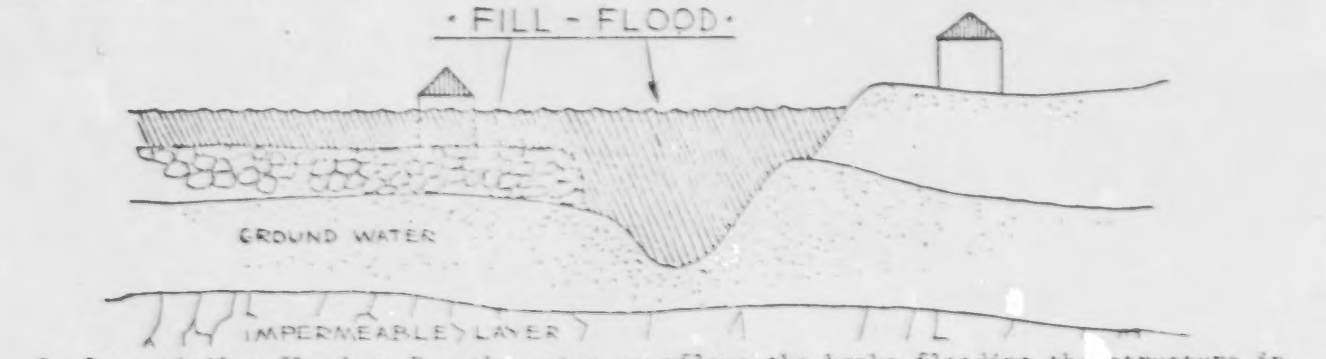


A. River or stream within channel.

B. After extensive rainfall, the river channel overflows. The flood plain fills with water serving its function as overflow basin.



C. A structure has been built on fill in the flood plain.



D. In a similar flood to B., the water overflows the banks flooding the structure in the flood plain. The fill has reduced the volume of water the flood plain can hold. Therefore, the high mark in D is several feet higher.

PURPOSE: To demonstrate some causes of floods.

LEVEL: 10-12

SUBJECT: Science

CONCEPT: Man has developed techniques useful in describing land and its uses.

REFERENCE: Fox, Charles E. Activities for Teaching Forest Conservation: Grade 10-2nd year College, Forest Service, U.S. Department of Agriculture, June, 1958.

ACTIVITY: Weigh a kitchen flour sifter carefully on scale in lab., grocery store, or meat counter. Record weight. Fill sifter to within an inch of the top with fine woods litter from the top 2 inches of soil just below the mat of raw litter. Weigh sifter with contents and record. Using a graduate showing fluid ounces (or it not available, a kitchen measuring cup), apply water steadily and very slowly to the litter. What measured volume of water are you able to add before it first starts to drip from the bottom of the sifter? Record the volume. This action is known as "priming" the soil.

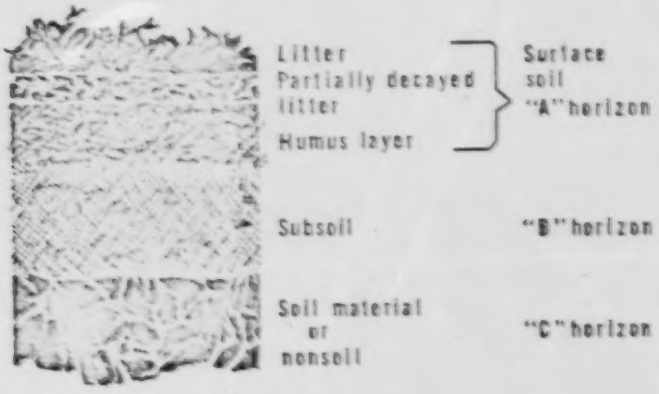
As soon as drip stops, measure out the amount of water found necessary for priming, and empty it quickly onto the same litter in the sifter. Catch the drip in a container and measure the volume.

How did the rate of flow from the sifter the second time compare with that in the priming?

Explain observations in terms of effect of gentle rain or slow snowmelt on floods as compared with heavy rain or rapid snowmelt.

A common figure used for the weight of accumulated litter on a forest floor is 6 tons per acre. Knowing the weight

of the litter in the sifter and the fluid ounces of water necessary to prime it, how many gallons of water would be required to prime similar litter in a forest of one acre? In a forest of 100 acres? What is the significance in terms of possible floods originating in such a forest?



PROFILE OF FOREST SOIL

Select an ungrazed woods and a bare unplowed field in the same general area. In mid-winter, chop and dig down through the soil in each location and determine the depth in inches to which the soil is frozen. Record these depths.

In which location would spring snowmelt be delayed longer? Why? Considering the factor of frozen soil alone, in which location would late winter and early spring rains be absorbed more readily? Why? Which soil would begin storing water first in the spring?

PURPOSE: To investigate advantages and disadvantages of a sanitary landfill.

LEVEL: 10-12

SUBJECT: Science

CONCEPT: Social and technological changes alter the interrelationships, importance, and uses for land.

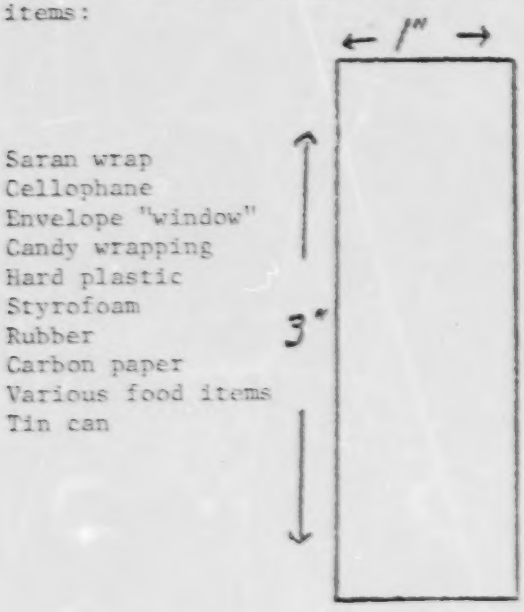
REFERENCE: Operation Survival Through Environmental Education: Senior High, Idea I, Land Manual. Environmental Education Project, Grafton, Illinois, Title III, ESEA. SE 014 502.

ACTIVITY: Population growth, convenience packaging and the projected increase of solid waste in the next ten years are contributors to a serious land use problem; i.e., solid waste. One of the most common methods of disposal is the open dump. This is not an acceptable method for many obvious reasons.

A better method than open dumping, that is becoming very popular, is the sanitary landfill. This method involves compacting the solid waste and covering it with a thin layer of dirt each day.

There are advantages and disadvantages of this type operation. Instruct your class that you are going to run an experiment to determine what materials should be placed in a landfill.

Cut four strips, one by three inches, of one of the following items:

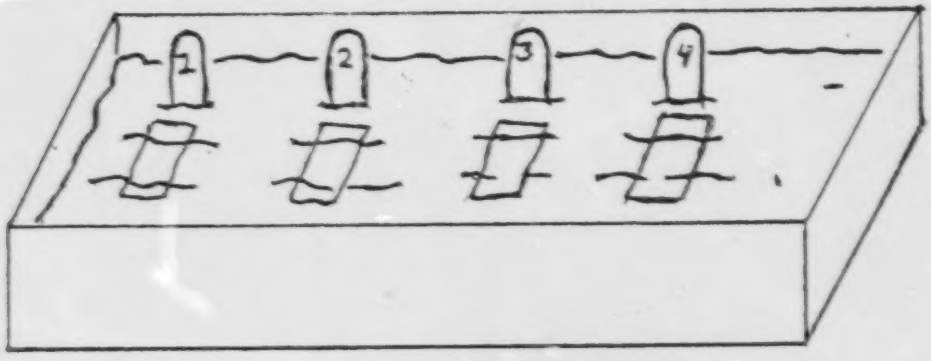


Saran wrap
Cellophane
Envelope "window"
Candy wrapping
Hard plastic
Styrofoam
Rubber
Carbon paper
Various food items
Tin can

Facial tissue
Paper towel
Typing paper
Ditto paper (with purple wax)
Notebook paper
Glossy magazine cover
Corrugated cardboard
Label paper from tin can
Aluminum foil

Collect garden soil in a deep tray, bread pan, or milk carton cut lengthwise. You might want to experiment with different types of soil. You will also need four markers, such as ice cream sticks.

Keep the soil moist but do not allow water to stand. Keep the samples at room temperature.



Observe and record on a data sheet, the characteristics of the material used. Then bury and mark the four items in your garden soil. After each week, dig up one item and observe its appearance. CAUTION: do not disturb the other buried items. Look for the roughness of the surface as well as tiny holes or Swiss cheese-like holes, and complete disintegration.

After completion of this activity, answer the following questions:

1. Which samples disintegrate rapidly? Which show very slow disintegration?

2. Make a list of the samples going from the most actively disintegrated to the least easily disintegrated.

3. From the above list, what material should be recycled by salvage?

4. List some problems that occur at a landfill operation.

5. List problems to consider before a community initiates a landfill operation.

(Problems that should be considered are: pest control; i.e. rodents, flies pathogenic bacteria; odor; air and water pollution; appearance; i.e. windblown litter; economics.)

PURPOSE: To illustrate how decisions regarding land use affect ecosystems, and have limiting effects on other uses.

LEVEL: 10-12

SUBJECT: Science
Social Studies

CONCEPT: Land use management to meet the needs of successive generations demands long-range planning since options available to future generations must not be foreclosed.

REFERENCE: A Handbook of Environmental Encounters. Oregon Department of Education, Instruction Division, pp. 110-111. ED 113 151.

ACTIVITY: Components in an ecosystem are so complexly interrelated that the change of any one of them may have far reaching ramifications for other components and for the entire system. For example, aerial fertilizers are spread to increase tree growth, but the water receiving the run-off may become choked with algae. A dam is constructed to provide power to encourage new industry, but an important salmon resource may be destroyed. A marsh is filled in to build a shopping complex, and the water table may be perilously affected.

Planners must study the possible effects of manipulating any one component of an ecosystem. Only in this way can intelligent and responsible decisions be made about such things as land use. Students can benefit by assuming as an analytical role in the study and discussion of land use.

ACTIVITY 1: FIELD TRIP-HIGHWAY LOCATION

Select an area being considered as the site of an interstate highway. (Instead of a highway it can be the proposed site of a nuclear plant, a factory or a subdivision.) Arrange a field trip to the area under the guidance of an engineer and/or planning official so that students can learn the social, economic, and ecological considerations involved in selection of the site. Data might be obtained on costs of construction, extent of land acquisition, relocation of families, and other factors.

From the data, the class should draw up a report on what happens when a major construction site is appropriated. The report should list both the positive and negative impact of such an action.

ACTIVITY 2: LAND USE SIMULATION

Have the class simulate the selection of a highway route. A teacher and student might explain the simulation as follows and then act as referees.

Objective: The "Planning Commission" is to make a decision regarding the Highway Commission's proposal to construct a highway through a marshy area.

Phase I. The Planning Commission (four people) is elected by the class. The election process should include class nomination of candidates and short speeches by the candidates.

Phase II. Lobbying groups should be set up, for and against the project. Brainstorming sessions should be held with the teacher or student at the blackboard in order to list as many groups as possible in 15 minutes. Be sure to include the Highway Commission as one of the groups. After all possible groups are included, attempt to combine them so that only four or five will participate in the simulation. These groups should be listed on the board, and each student should join the group that interests him most. Make an attempt to balance group sizes within limits.

Phase III. The Planning Commission and lobbying groups should meet individually for 20 minutes in order to get acquainted. Each group should elect a chairman or spokesman and plot strategy.

Phase IV. All groups take their places in the hearing room, which is arranged as it might be in a planning meeting. Call the meeting to order. An opening statement should be delivered by the Planning Commission. This might be followed by the highway engineer's presentation to the commission. Open the hearing the statements from the floor. A time limit should be set. A decision should then be made by the Planning Commission.

PURPOSE: To understand the watershed concept of land use management.

LEVEL: 10-12

SUBJECT: Social Studies
Science

CONCEPT: Land use policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.

REFERENCE: Gail, Peter A., et al. A Curriculum Activities Guide to Watershed Investigators and Environmental Studies, p. 8. ED 104 651.

ACTIVITY: John Wesley Powell, statesman and explorer, noted in the late 1800's that watersheds are the only logical geographical land use planning units. His wisdom had been overlooked by most planners until recently. Political boundaries cut across watershed boundaries, often dissecting a single watershed into many political units, each autonomous from the others. Counties often use major rivers as boundaries, creating a split down the middle of the watershed, in which those with authority on each side of the river have different ideas about how to use it. Development or regional planning districts often include parts of many watersheds but seldom the entire watershed of any major stream. Under these conditions, it is obvious that any attempt to clean up water in a town downstream would have, without equal commitment from all towns upstream, little chance to succeed.

Watershed studies are investigations of the use and misuse of the land which drains into a stream. Water quality in the stream draining the land is an index of land use quality, and as such is only part of a watershed analysis. It is important that a watershed study begin with a general overview of the entire watershed - its land use, people, potential problems, and stream survey, not just the latter. The watershed is a geographical region in which you begin. Once the problems are identified and understood, the search for answers may extend well beyond the boundaries of the watersheds, possibly into studies of,

-laws and potential laws that could alleviate the problems at the local, county, state and federal level;

-the processes in society that create the problems and alternatives available to solve them;

-costs and benefits of alternative solutions;

-history of the problems and peoples' attitude toward them;

-ways of stimulating people to correct the problems;

all of which involve social sciences and none of which are concerned with water pollution per se.

1. Using topographic maps, determine the boundaries of the watershed(s) in your community. Locate your home and/or your school within the watershed(s). (NOTE: This is often extremely difficult, perhaps impossible, in urban areas).

2. Make a watershed map of your community and its surroundings. Superimpose on it political subdivisions---county lines, city limits, township boundaries, and the like. Determine why, or speculate as to why, political boundaries were drawn as they were, and how they relate to watershed boundaries.

3. Consider these questions:

   a. What advantages might there have been, had watershed boundaries been used locally in determining political boundaries?

   b. How does land use in an upstream area have implications for those living downstream? Extend this to environmental considerations, such as water pollution.

   c. If political boundaries were identical with watershed boundaries, what advantages might exist for community land use management?

This activity might be used as a "starter" for a more thorough watershed study, or as a starter activity in itself. Teachers wishing to pursue this topic further will readily relate it to other activities in this volume, and may wish to consider the references listed above.

PURPOSE: To identify some possible uses for one square mile of county farmland near a city.

LEVEL: 10-12

SUBJECT: Social Studies
Science

CONCEPT: Physical characteristics of the natural environment are of major importance in determining land use.

REFERENCE: Teaching Materials for Environmental Education: Investigating Your Environment. Forest Service, U.S. Department of Agriculture, July, 1973. SE 016 922.

ACTIVITY: Instruct your class that they are going to participate in a simulation game concerning land use in a hypothetical community. The problem involves identifying some possible uses for a one square mile (640 acres or 259 hectares) of county farmland four miles northeast of the hypothetical city of Centerplace, population 250,000.

BACKGROUND INFORMATION FOR CENTERPLACE CITY

-The population is 250,000 and rapidly increasing.
-The city's boundaries are being extended, but the suburban fringe is expanding even more rapidly.
-The rapid population growth is accompanied by demands for more housing, more jobs, additional city services, and recreational areas.
-The power for industrial uses, adequate public transportation, and skilled labor force are available.
-The city is located near forests, to the north.
-The land to the east is devoted mainly to farming.
-The Pipe River is unpolluted and is the source of irrigation water as well as the municipal water supply.
-The river is too small for freight transportation, but logs could be floated on it.
-The gravel bed of the river is appropriate raw material for concrete manufacture.
-The present sewage treatment plant and garbage disposal area are at maximum capacity.
-The citizens of Centerplace are concerned about the maintenance of a scenic regional environment.
-The County Board of Commissioners is the authority for land zoning, and many citizens' groups are being formed to influence zoning decisions.

1. Ask your class as a group to suggest some possible uses for the undeveloped land. As they respond, write on the chalkboard all comments just as they are stated. (Instead of paraphrasing if they are too wordy, ask: "How shall I write that on the board?") List all suggestions, specific or general. (Number the items as you go along to simplify identification later.)

2. When you feel you have enough material, ask "Which of these possible uses are similar?" Designate similar uses by letters, symbols, or colors. When most are designated, or the group seems to run out of thoughts, stop. Change items among categories if the participants change their minds. Do not get bogged down in the details of grouping. For example, if some people think one use should be in another category, then put that use in both categories.

3. Next, determine labels that are appropriate for all items in each category such as recreation, industrial, utilities, housing, commercial, etc.

4. Divide the class into the number of land use categories identified, with not more than eight persons per section. Assign one of the categories to each group for them to represent. (One way to set up groups is to have the total group count off by the number of categories identified.)

   Inform the groups that they have 10 minutes to list and analyze the advantages and disadvantages of possible uses for the vacant land in the assigned category. They may consider those listed on the board plus any other possible uses they can think of in their category. (It is important to stress that this task is to just analyze the uses of the land.)

5. After about 10 minutes, announce: "We have just received word that because of the current workload from reading environmental impact statements, the members of the Board of County Commissioners have all resigned. Each group has one minute to elect one member to represent them on the Board."

   After the new board members have been selected, give them the following information sheet and assign them to a separate meeting place to (1) elect a chairperson, (2) review the information, (3) read announcements at the bottom of the information sheet, and (4) select a timekeeper. (See Information Sheet on following page.)

INFORMATION SHEET (County Board Members Only)

"One square mile (640 acres or 259 hectares) of unused county farmland, four miles northeast of the city, is now available for the city's use."

Using this information, your task is to:

1. Develop criteria to evaluate the proposals.
2. Develop a system to record your evaluation of each proposal.

Background Information for Centerplace City

-The population is 250,000 and rapidly increasing.
-The city's boundaries are being extended, but the suburban fringe is expanding even more rapidly.
-The rapid population growth is accompanied by demands for more housing, more jobs, additional city services, and recreational areas.
-The power for industrial uses, adequate public transportation, and a skilled labor force are available.
-The city is located near forests, to the north.
-The land to the east is devoted mainly to farming.
-The Pipe River is unpolluted and is the source of irrigation water as well as the municipal water supply.
-The river is too small for freight transportation, but logs could be floated on it.
-The gravel bed of the river is appropriate raw material for concrete manufacture.
-The present sewage treatment plant and garbage disposal area are at maximum capacity.
-The citizens of Centerplace are concerned about the maintenance of a scenic regional environment.
-The County Board of Commissioners is the authority for land zoning, and many citizens' groups are being formed to influence zoning decisions.

Group Making Presentation (use category)	Criteria to Evaluate Proposal (Rating)					
	1	2	3	4	5	6

Elect a chairperson to preside during the presentations to the group and to run the meeting in an orderly manner (5 minutes). Announcements to be made by the chairperson:

-Because of time constraints, there will be no rebuttal after presentations.
-The Board may ask two or three clarifying questions of each group after all the presentations.
-You have 3 minutes to give your presentation. You will be given a warning when you have 1 minute left.

6. After the Board leaves the room, make this announcement to the groups:

> "You have about 15 minutes to finish your plan and develop a 3-minute presentation to be made to the County Board of Commissioners. Your 3-minute presentation must include a visual display, such as a land use map, as a part of your presentation, and more than one person in each group must participate in making the presentation."

7. When all groups are ready, have the Board enter the room and sit at the front. The chairperson makes the announcements from the Information Sheet and sticks to them, in order to keep the process moving. The timekeeper is to stop all presentations at 3 minutes and give 1-minute warnings.

8. When the presentations are finished, the Board retires for 5 to 10 minutes to select the best proposal.

   While the Board is meeting, each group is to develop a list of criteria that they think should be used in evaluating the plans submitted. Pass out additional Information Sheets to use in developing the criteria.

9. The County Board re-enters the room, reads their criteria aloud, announces their decision, and reads criteria used in making the decision. Board adjourns.

10. The following questions and discussions are suggested to conclude the activity:

    A. "What additional data would you have liked to have had for planning your group's proposal?"

       As examples, list on board: Topography, vegetation, economy of area, railroad, shopping center, adjacent land, climate, soil survey, historical information, flood plain, wildlife, interest of board of control, money available, educational needs, regulations by State, existing zoning, political climate, population information (age needs, race, jobs).

    B. "Where would you go to collect information on these topics?"

    C. Point out to the class that this is one of the most important parts of the activity because it emphasizes that we need a variety of information and data before we can intelligently make a land management or environmental decision to best meet the needs of people and their environment.

ADDITIONAL INFORMATION SHEET

"One square mile (640 acres or 259 hectares) of unused county farmland, four miles northeast of the city, is now available for the city's use."

Using this information, your task is to analyze and list possible consequences of different land uses within your assigned land use category. Do not decide which is the best use.

Background Information for Centerplace City

-The population is 250,000 and rapidly increasing.
-The city's boundaries are being extended, but the suburban fringe is expanding even more rapidly.
-The rapid population growth is accompanied by demands for more housing, more jobs, additional city services, and recreational areas.
-The power for industrial uses, adequate public transportation, and a skilled labor force are available.
-The city is located near forests, to the north.
-The land to the east is devoted mainly to farming.
-The Pipe River is unpolluted and is the source of irrigation water as well as the municipal water supply.
-The river is too small for freight transportation, but logs could be floated on it.
-The gravel bed of the river is appropriate raw material for concrete manufacture.
-The present sewage treatment plant and garbage disposal area are at maximum capacity.
-The citizens of Centerplace are concerned about the maintenance of a scenic regional environment.
-The County Board of Commissioners is the authority for land zoning, and many citizens' groups are being formed to influence zoning decisions.

List possible uses of the land:

_____	_____
_____	_____
_____	_____
_____	_____

Use	Advantages to land/people	Disadvantages to land/people

PURPOSE: To identify factors involved in land use planning.

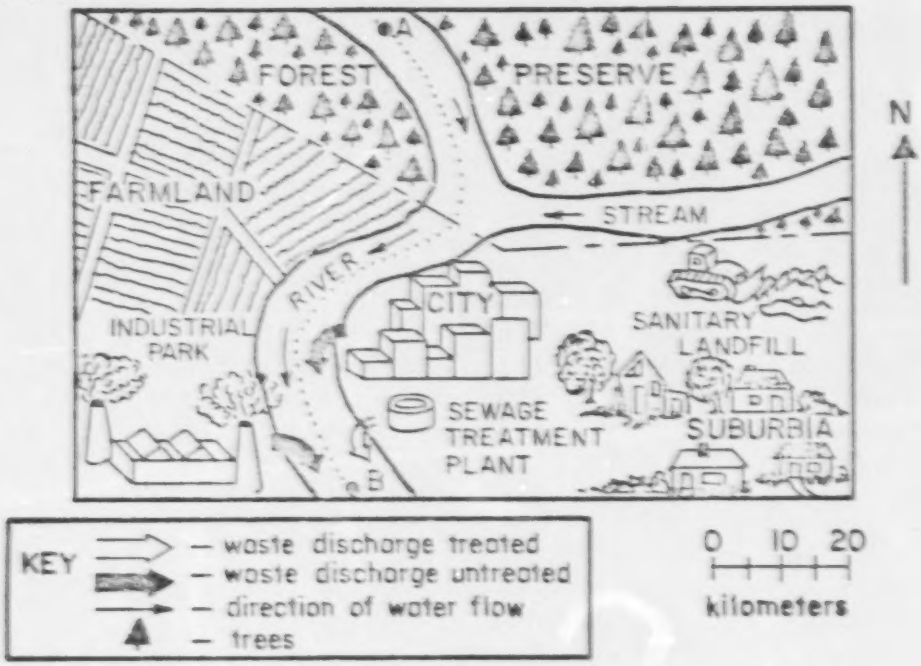
LEVEL: 10-12

SUBJECT: Social Studies
Science

CONCEPT: Land use management to meet the needs of successive generations demands long-range planning since options available to future generations must not be foreclosed.

REFERENCE: An Environmental Syllabus: Grade 10, 11, 12. New York State Education Department, pp. 89-90. SE 022 615.

ACTIVITY: Good land use planning is an important aspect of environmental conservation and improvement. Conduct a class discussion on planning practices with the aid of the map and questions below.



1. Which landscape region has probably been altered least by human activities? Explain.

2. Describe the likely rates of surface water runoff during a 1-hour light rain on the four areas (forest preserve, suburban, city, and farmland) by arranging them in order from most to least runoff. Explain.

3. What effect might a second industrial park have upon the environment? Where might it be located?

4. Should people living here support legislation to rezone this land to allow for a second industrial park? Why or why not? Give some advantages and disadvantages.

5. Does the map represent a well-planned area? Explain. What changes could be made to improve the area's environmental quality?

PURPOSE: To study land use patterns through remotely sensed data.

LEVEL: 10-12

SUBJECT: Social Studies
Science

CONCEPT: Man has developed techniques useful in describing land and its uses.

REFERENCE: What's the Use of Land? Jefferson County, Colorado. Public Schools. ED 138 538.

ACTIVITY: This activity describes considerations appropriate to performing a rural survey for the purpose of studying agricultural land use, as an example of how remotely sensed data may be of use in land use studies. More detail, and more thoroughly developed land use studies employing remotely sensed data, are presented in What's the Use of Land?, prepared by Jefferson County, Colorado, Public Schools, and published by the National Aeronautics and Space Administration.

To perform such a study using remotely sensed information, the following data should be obtained: a local "gas station" map, aerial photographs, multispectral space photographs, and U.S. Geological Survey maps. (See Appendix C for information as to how these items may be obtained).

First, the students should study the area of concern on each of the above data. Each set of data would then be related to the others to obtain a thorough understanding of the area of the survey. The gas station map will present the area in a large scale and in a format familiar to the user. It will generally orient the area in relation to streams, lakes, cities, highways, and railroads. The aerial photographs reveal the study area in a scale so the user can recognize all major features--buildings, fields, structures, rivers, vegetation, etc. The aerial photographs can be obtained in approximately the same scale as the USGS maps that define geological features. Space photographs are valuable in this type of study because they show the watershed areas, streams, valleys, and general land formations in a large area. Multispectral photographs from aircraft or spacecraft can be used for crop identification and detection of crop disease.

After students are familiar with the data collected and have combined the essential features on a single layout, a field trip should be made to the study area to compare actual conditions to those indicated on the maps and photographs and ensure that the layout is up to date. To identify the crops that were in each field at the time the multispectral

pictures were obtained, the user must identify at least one field of each crop in the area. This will make it possible to establish the "spectral signature" of that crop as derived from the multispectral pictures and then to identify every like crop in the area by merely analyzing the multispectral photographs taken during that same growing season. Refer to Observing Earth from Skylab, NP-56/1-75, and the Skylab Earth Resources Data Catalog for more information regarding the interpretation of multispectral photographs. The technique consists of comparing the gray tones in the photographs with a graduated gray scale, such as is marketed by Kodak, and recording the set of tonal values for each field. All fields with the same combination of tonal values (spectral signature) should have the same crop in the same state of growth.

To determine the total area planted to each crop in the scene, students can measure the area of all the fields with the same "spectral signature." Also, by similar analysis of multispectral photographs of the same scene taken throughout the growing season, the relative health of the plants can be determined, thereby allowing students to estimate the yields of the crops.

High resolution and infra-red photographs can be used to locate irrigation ditches and to differentiate between the irrigated and dry-land farming areas.

After the spectral signatures have been established for the entire area, a field trip should be taken to fields not visited previously to verify the accuracy of the survey. The final results should be coordinated with the local farm bureau office where these types of data are gratefully received. Here, students can get an appreciation of the reasons for rural surveys.

PURPOSE: To describe some of the procedures involved in the preparation of our environmental impact statement for a given site and project.

LEVEL: 10-12

SUBJECT: Social Studies
Science

CONCEPT: Land use policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.

REFERENCE: Project Learning Tree. Supplementary Curriculum Guide for Grade 7 Through Grade 12. Copyright 1977 by American Forest Institute. Reprinted with permission of AFI.

ACTIVITY: On January 1, 1970 the United States National Environmental Policy Act (NEPA) came into being. It created a new preventive mechanism for dealing with environmental problems. The heart of NEPA is found in Section 102. This section requires that all federal agencies prepare a "detailed statement" on "every recommendation or report on proposals or legislation and other federal actions significantly affecting the quality of the human environment." Specifically, these statements, now known as Environmental Impact Statements (EIS), are required for all projects directly undertaken by federal agencies; supported in whole or in part by federal agencies, contracts, grants subsidies, loans, or other forms of assistance; or requiring a federal lease, permit, license, or certificate, which meet the "significance" test.

Since EIS's are intended to assess the impact of a proposed action, a draft statement must be prepared at least 90 days before the proposed action for review by appropriate federal, state, and local agencies as well as the public. Once a statement has been prepared and reviewed, comments received during the review process must be answered. A final statement, incorporating all comments and objections and their resolutions, must then be made public at least 30 days prior to the proposed action.

If any of the reviewing agencies or members of the general public feel that the prepared statement is inadequate, they may file a court suit to require further research into the project's environmental impact. The adequacy and completeness of the EIS is then determined through traditional judicial procedures. If the EIS is found inadequate, it may be revised and resubmitted. If the statement is deemed adequate, the proposed action may proceed. However, if the predicted consequences are seriously detrimental, further litigation may be brought to prohibit the proposed action.

Environmental Impact Statements are not intended to be justification for proposed funding or action. They are simply detailed presentations of the environmental impacts of and alternatives to the proposed project. The EIS are not intended to screen alternatives solely on the basis of environmental impact. They are prepared to ensure that environmental amenities as well as technical and economic considerations and public desires are equitably considered.

In this activity students are asked to use the following data to prepare Environmental Impact Statements according to guidelines suggested by the Environmental Protection Agency. The completed statements are then reviewed at a simulated public hearing held by the agency that wrote the statement.

Initial Procedure

As a class, study the attached suggested guidelines for preparing an EIS. It would be helpful to obtain several actual EIS reports prepared for projects in or near your community. Students could examine these as they review the guidelines.

Divide the class into teams of three to five students each. Then ask each team to prepare an EIS for the Picnic Point Park proposal from the data provided here.

Data

1. The situation: A point of land on nearby Balsam Lake (a federal water impoundment), has been a favorite informal beach for many years. The point is easily accessible although a railroad track on private property must be crossed to get to the beach. It has considerable use because it is one of the few public beach areas left easily reached by residents of the surrounding area. Last year it received 30,000 visitor-days of use.

After several meetings, the Bureau of Reclamation which administers the area, has decided that Picnic Point should be proposed as a recreational beach site. An EIS must be submitted because the proposed action will be funded by federal money. Responsibility for preparing the EIS rests with those making the proposal, in this case the Bureau of Reclamation. The EIS which is prepared will be reviewed at a public hearing held by the Bureau to meet NEPA's requirements.

2. The existing environment: Physical features of Picnic Point include a sandy-gravel beach; a creek running through the park area and emptying into Balsam Lake; and an area graded, but not yet surfaced, for a parking lot.

Biological characteristics to be considered relate to the lake, the land, and the creek. Balsam Lake is a large, quite deep, manmade lake. It is now relatively unpolluted and contains several kinds of fish with trout the most abundant. However, the water quality is beginning to show some signs of deterioration, possibly because untreated sewage enters the lake from homes and summer cabins on the shore. The lake's edge has algae attached to large pebbles and boulders which attract algae-eating animals and their predators. The shallows serve as a breeding area and habitat for several kinds of animals. Water birds also are lake residents.

The land area once was covered with a forest of western red cedar and hemlock. Since these trees were logged off 50 years ago, bigleaf maple, red alder, a few Douglas firs, and a wide variety of berry and flowering plants have grown up to cover the site.

Picnic Creek is a fast-flowing stream, not very wide or deep. When it floods, it carries silt from bank cuts, sand, and some larger debris into the lake. The water generally is clear and of high quality except for excess numbers of coliform bacteria; the bacteria count is two to three times the number safe in water for human use.

3. Proposed park development: The development of Picnic Point would include these features:

Construction and maintenance of an asphalt parking lot for 48 cars, with a bus stop and turn-around; concrete t[illegible]rooms; a pedestrian railroad underpass 35 feet long, 10 feet wide, 8 feet high and 4 feet below (12 meters long, 3 meters wide, 2.75 meters high, and 1.5 meters below) the tracks; a picnic area on the sandy land between the beach and the railroad; a gravel fill to protect existing trees along the railroad track; walkways; landscaping for shade and sand and soil stabilization; and a settling basin for Picnic Creek located just east of the railroad tracks.

Rules prohibiting camping; horseback riding; motor vehicles; log cutting; fires except in designated facilities; unleashed dogs; excessive noise or congregating of groups; pop-open cans; and damage to vegetation, soil, sand, facilities, or native animal life.

4. Design considerations: The development must have plans for sewage disposal from restrooms. Ideally this would be accomplished by building a lift station and force main to transfer sewage to the community's new treatment plant now under construction about 3600 feet (1200 meters) from the restroom location.

The design also must allow for sealed catch basins in the parking lot to prevent hydrocarbon run-off into Picnic Creek and consider the flow increment added to the creek by water run-off from the new asphalt parking lot. Although a large flow is not expected, actual data are unavailable.

The development of the beach area is expected to increase its use from about 30,000 visitor-days annually to 47,000. Facilities must be designed to meet the needs of this greater use.

Concluding Procedure

After the students have completed their EIS reports, the documents should be compared.

Ask the students to discuss:

> How the statements differ in their assessment of the significance of the environmental impact, the alternatives they propose, and the evaluation of the short- and long-term benefits of the proposal.
>
> Whether each group considered the project's impact differently. Whether you might have expected all the groups to reach the same conclusion. Why or why not?

Select one member from each of the teams to serve on a simulated Department of Ecology panel which is holding public hearings to receive comments on the EIS prepared. In this hearing, panel members will question the consultants who prepared each EIS to clarify ambiguities or conflicts in conclusions. Students serving on the panel will have the benefit of participating in the process of writing the EIS. Once on the panel, however, they should no longer speak as if they had prepared the statements. They are now "respected citizens" questioning consultants about the EIS they have prepared. Another group of students might want to assume the role of interested citizens for the purpose of testifying at the hearing.

Variation

In this activity students will prepare an EIS for a hypothetical or actual study site in your community, using either the federal guidelines or their state's statutes.

Here is the hypothetical situation:

> An area in your community has been selected as the site for a 100-unit, two-story condominium housing development.

The site has sewer and water lines within easy access. All existing trees on the land must be removed, but the developers agree to landscape the site when the building is completed. An excavation for the basement also is necessary.

Through class discussion, try to determine:

An appropriate location for the proposed condominium development. (If an actual project which has filed an EIS statement is underway locally, you may prefer to use this for class study.)

Is a site study (EIS) necessary before development may be approved? If so, why?

What are the important environmental factors which should be measured before preparing an EIS? In other words, what data must be collected? How would these factors be measured?

What is meant by "short-term impact" and "long-term impact"?

How long is "long"?

Divide the class into several consultant teams. Each team is to collect part of the necessary data as suggested in the following EIS guidelines and/or according to your state's environmental protection statutes, and write a report.

While doing their research, students could consider:

1. A description of the physical and biological resources of the site.

2. How the existing biotic (life-related) community has adapted to the physical environment.

3. Soil characteristics.

4. Air and water quality.

5. Climatic conditions including average rainfall, seasonal temperature extremes and averages, number of sunny days.

6. Accessibility of utility lines and transportation links to the site.

7. Unique or unusual characteristics of the site.

After the data have been collected, follow the procedure outlined in the first activity. Teams can prepare EIS reports from the same data and present them at a public hearing.

Environmental Impacts

1. Discuss impacts which may occur to water quality, air quality, noise, solid waste disposal, and pesticide use.

2. Discuss the impacts the project will have on the physical environment such as soils, geologic formations, hydrology, drainage patterns, etc.

3. Discuss methodology to be used to minimize adverse environmental impacts. Where abatement measures can reduce adverse impacts to an acceptable level, the basis for considering these levels acceptable must be outlined.

4. Discuss the economic impacts of the proposed action.

Alternatives

1. Discuss the full range of management alternatives considered in the course of planning the action. The null alternative (the alternative of taking no action) must also be evaluated.

2. Discuss why the proposed alternative was chosen.

3. Discuss alternatives in sufficient detail so others may realize secondary or long-term environmental impacts.

Short-Term Use VS Long-Term Productivity

1. Discuss environmental impact and economic costs and benefits as they relate to short-term uses and long-term productivity.

2. Discuss how actions taken now will (or will not) limit the number of choices left for future generations.

Irreversible and Irretrievable Commitment of Resources

Discuss resources to be utilized and what the replacement potential of these resources is.

PURPOSE: To consider the question of exercising selection over who may or may not move into a community.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Increasing population and per capita use of resources have brought changed land to man or resource to population ratios.

REFERENCE: Swanson, Barry W. Environmental Quality: A Community Concern. New York State Department of Education.

ACTIVITY: Discuss the following newspaper excerpts with the class.

The new "land ethic" has implications that reach far beyond land itself. It is already affecting millions of people—what they can do with their property, where they can build or buy new homes, how close they will be living to industry, power plants and shopping centers, where they spend vacations, and in countless other ways. It involves the development of new governmental mechanisms: altered local-state and state-federal relationships; and, above all, concerned public consideration of how people want the country to look and function in years to come.

"Public Control Growing in Land Use Revolution"
New York Times, September 3, 1973.

A number of communities have already begun thinking about establishing population ceilings. While this is logical, in practice it is on a collision course with the constitutional provision that citizens have the right of free travel—and inferentially the right of settlement—among the states.

"New Land Ethic: Its Spread Raises Political and Legal Issues to be Resolved by Public"
New York Times, September 4, 1973.

Have a committee develop a report on the question of whether or not communities may take the next step beyond zoning (planning and shaping their own characteristics), that of limiting or excluding population growth which results from in-migration (exercising selection over the characters who may live there.) A recent court fight concerning the community of Petaluma, California centered on this very issue.

If you lived in a location that was judged extremely desirable by significant numbers of people, many of whom were potential migrants to your locality, would you wish to be able to decide how many people should share your contentment? Explain, citing a real or hypothetical locality, its attractions, and your reasons for either sharing or maintaining exclusivity.

PURPOSE: To understand how technologic innovation influences the use of land.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Social and technological changes alter the interrelationships, importance, and uses for land.

REFERENCE: An Environmental Syllabus: Grades 10, 11, 12. New York State Education Department, p. 87. SE 022 615.

ACTIVITY: A major factor in changing patterns of land use during our nation's history has been the success of technology in the development of the country. Numerous examples are possible; this activity will lead to the identification and consideration of many of them.

Using the periods 1790-1860, 1865-1930, and 1945-1970 in our nation's history, have each student list ten major technological advances or discoveries in each, describing the direct or indirect impacts which these advances or inventions had upon the way land was used. Examples might include:

Automobile --- highway construction....

Locomotive --- railway construction....

Telegraph --- instantaneous communication....

Drag line --- strip mining....

If each student makes his own listing, a "pooled" listing by the class will likely lead to an in-depth consideration of the effects of technologic advance on land use.

PURPOSE: To understand how land use decisions are made within the local community.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Zoning is a practice in which land uses are prescribed based upon value judgments regarding the needs of society.

REFERENCE: An Environmental Syllabus: Grades 10, 11, 12. New York State Education Department, p. 95. ED 022 615.

ACTIVITY: Invite a member of the town board planning staff to the class to discuss the serious priorities, zoning laws, and problems related to land development in responses to a list of questions carefully developed in advance. Of particular interest will be the planner's explanation of land use priorities.

Questions might include:

1. Who is responsible for determining land use priorities for the local community?

2. Who is responsible for carrying out land use policy locally? How is this accomplished?

PURPOSE: To learn how governmental agencies organize and interact for land use planning and improvement.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Land use responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: An Environmental Curriculum: Grades 10, 11, 12. New York State Education Department, pp. 86, 90-91. SE 022 615.

ACTIVITY: Land use planning and management are currently subject to a variety of regulations and policies, determined at many levels of government--Federal, State, and local. There is no governmental body charged with overall responsibility for determination of land use planning and management. Rather, a number of governmental agencies share responsibilities, sometimes cooperatively, sometimes competitively, because their specific missions have land use implications.

1. Study the organization and functions of appropriate Federal, State, and local governmental agencies to determine what responsibilities they have with respect to land use management. A list of Federal agencies having land use management and planning functions is reproduced in Appendix B, pp. 528-531; no such list is supplied for state and local governments because they vary from state to state, locality to locality. What are the specific, land-use-related functions of such agencies, at all levels of government?

2. Research the policies of such agencies which govern, or influence, the use of land. For what reasons do they have such policies?

3. How do governmental agencies at all levels work cooperatively, or competitively, with respect to land use planning and management? (This question will be a difficult one; it may be impossible for students, unless they can secure information from agency personnel. Local offices of any of the federal agencies should be contacted for assistance, while local planning agencies will be supportive of student requests for assistance in varying degrees.)

4. Explain how popular opinion and private interest group pressure can or does influence the policies of governmental agencies with respect to land use. In many localities, such organizations as the Sierra Club, the

League of Women Voters, and the Nature Conservancy (for examples only) have had great influence on local land use.

5. How will land use patterns in the United States, in your own state, in your own locality be changing in the next decade, in light of what you have learned about the activities of federal, state, and local agencies in land use planning and management?

PURPOSE: To investigate the land management concerns of conservation-oriented private organizations.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Land use responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: An Environmental Syllabus: Grades 10, 11, 12. New York State Education Department, p. 92. SE 022 615.

ACTIVITY: Over time, a number of private, non-profit organizations have been formed by individuals seeking to promote preservation and/or conservation objectives. Many of them pre-date the environmental concerns of the recent past, but many have found new support and added incentive from the "environmental movement." One of the common threads among their objectives is a concern for conservation with respect to land use management.

Among such organizations are the Nature Conservancy, Friends of the Earth, the Sierra Club, and the National Audubon Society, to mention a few. Similar organizations exist on state and local levels.

Assign reports on the history, structure, objectives, and successes and/or failures of such organizations. Among questions appropriate for consideration are:

1. What have been the impacts of these organizations upon land use planning, preservation, and conservation?

2. How are the land use objectives of these organizations related to their overall objectives?

3. What specific programs or activities have these organizations supported, relative to land use management?

4. How do these organizations operate on the local level? (For example, have they been active in the local area, and if so, how?)

5. Should such organizations be publicly supported with governmental funds? Why or why not?

6. How do such organizations work cooperatively with governmental agencies?

It is often possible to solicit the support of such organizations for local school programs, including guest speakers for assemblies or classes, etc.; they are likely to be quite willing to discuss their organizations, objectives, and the like, with students. Invite a member of such an organization to talk with the class.

PURPOSE: To observe land use issues in the local community.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Land use policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.

REFERENCE: An Environmental Syllabus: Grades 10, 11, 12. New York State Education Department, p. 90. SE 022 615.

ACTIVITY: Over a short period of time, students should compile a collection of news items which deal with specific local issues of land use (e.g., the construction of apartments; a new road; urban redevelopment, etc.). Discuss these specific incidents in class, weighing or ranking them in order of significance according to: size of the land area involved; impact on population; short- and long-range consideration of public services, etc.

Class members should assume the roles of interested parties in a specific land use issue (real estate agent, land developer, banker, average citizen, tax collector, mayor, Chamber of Commerce president, environmentalist, fire chief, etc.) dramatize the vested interests involved, and try to settle the issue for the sake of the greatest number of people. An outcome could be a master plan for land use.

PURPOSE: To experience land use decision-making activities.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Land use responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: An Environmental Syllabus: Grades 10, 11, 12. New York State Education Department, pp. 92-95. SE 022 615.

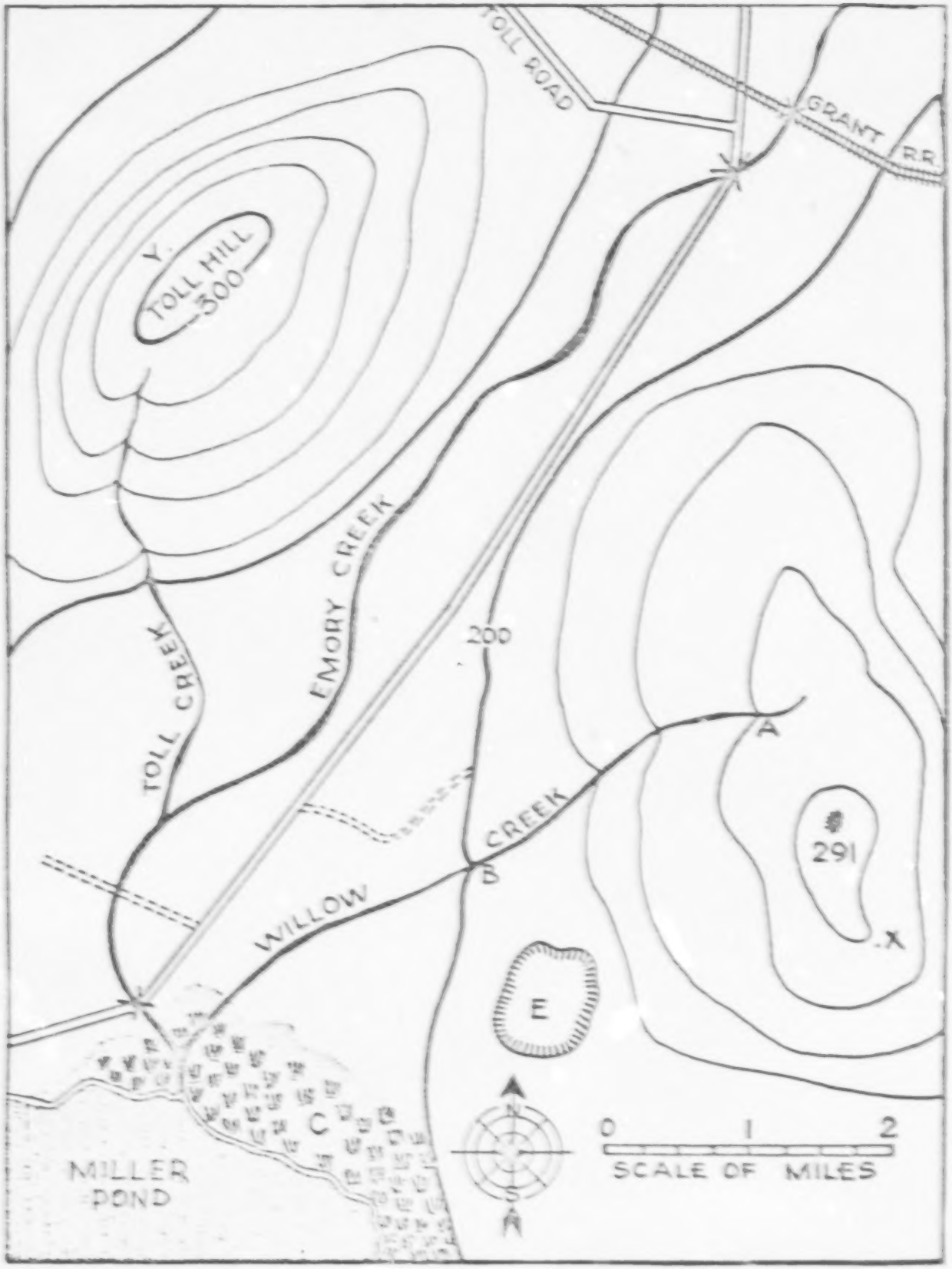
ACTIVITY: The tract of land illustrated on the accompanying map (next page) represents a rural area given to the town of Hillcrest by a family which, for generations, owned the land. Several specific conditions were stipulated in the agreement:

- -No more than 20 percent of the land might be sold by the town for single family residences.
- -No more than 20 percent of the land might be sold by the town for commercial establishments.
- -No more than 10 percent of the land might be sold by the town for apartments and condominiums (each building shall consist of no more than eight units.)
- -The remaining 35 percent of the land might be used for commercial recreational areas.

The former owners further directed that the town board appoint a committee of nine local residents to serve on an advisory committee to develop plans for implementing their conditions.

Instruct nine members of the class to serve as members of the advisory committee. The committee should develop plans and ordinances to implement the agreement. Some preliminary calculations should be made before planning begins.

- -How many square miles are there in this tract of land? How many square kilometers?
- -How many acres are there in the tract of land?
- -What is the contour interval?
- -Where is there a steep slope? ... a gentle slope?
- -Where is the area level?
- -What is the elevation of the highest point? the lowest point?


TOLL ROAD
GRANT R.R.
Y.
TOLL HILL
300
TOLL CREEK
EMORY CREEK
200
A
291
X
CREEK
B
WILLOW
E
C
MILLER
POND
N
S
0
1
2
SCALE OF MILES

-Where is the location of a hilltop? ... a depression? ... a swamp?

-What is the depth of the depression?

-How do contour lines indicate streamflow?

-How are directions indicated?

-What is the gradient of each of the streams?

Construct several profiles through various areas of the region.

Have the class develop maps of proposed, alternative land uses for the tract which can be made into a coordinated set of overlays for overhead projection and discussion.

The suggestions, compromises, and trade-offs which result from this discussion should be prepared as a report to be submitted to the student "advisory committee." The committee would then either act upon the plans or suggest amendments while returning the plans to the class. (This step must be repeated several times.)

Assign responsibility for preparing a complete, written report of the experience.

PURPOSE: To learn what professionals consider as important tools in land use decision making.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Man has developed techniques useful in describing land and its uses.

REFERENCE: Garlasco, Chris and others, Local Implementation and Land Use Decision Making, Area Cooperative Educational Services, New Haven, CT, Environmental Education Center, 1975. ED 133 216.

ACTIVITY: The information on the following page will be useful in framing an approach to land use management studies. It may be particularly appropriate as an introductory presentation for senior high school students, in that it sets forth key parameters necessary for consideration in land use decision making. Care must be taken that students are not overawed by the variety of topics of concern, but that they see them as indicators of the types of expertise needed. Students must realize that it is unrealistic to expect them to develop such diverse expertise at this point in their studies.

In October 1974, over two hundred individuals directly involved in land use decision making in Connecticut were surveyed to obtain their perspective on the priorities for citizen information about land use. The following table summarizes the results by giving the percentage of respondents indicating each choice.

The information presented in the following table will be useful in framing an approach to land use management studies. It may be particularly appropriate as an introductory presentation for senior high school students, in that it sets forth key parameters necessary for consideration in land use decision making. Care must be taken that students are not overawed by the variety of topics of concern, but that they see them as indicators of the types of expertise needed. Students must realize that it is unrealistic to expect them to develop such diverse expertise at this point in their studies.

	Very Important	Important	Of Limited Importance
General map reading skills			
Ability to interpret:			
*topographic maps	100%	--	--
+bedrock-geology maps	26%	54%	20%
surficial geology maps	15%	45%	40%
*zoning maps	87%	11%	2%
+aerial photographs	14%	65%	21%
*soil survey maps	82%	12%	6%
unconsolidated material maps	9%	25%	66%
Knowledge of:			
+basic soil types	17%	80%	3%
+percolation rates	16%	74%	10%
historical landmarks	13%	37%	50%
+unique habitat	26%	62%	12%
*flood prone areas	80%	17%	3%
+unique vistas	10%	70%	10%
*wetland regulations	78%	20%	2%
*available ground water	81%	17%	2%
+zoning ordinances	31%	65%	4%
condemnation procedures	0%	18%	82%
the taking issue	0%	26%	74%
Riparian rights	0%	9%	91%
+air quality regulations	23%	64%	13%
+water quality regulations	21%	64%	15%
health regulations	61%	35%	4%
tax laws	36%	34%	40%
*septic systems regulations	61%	35%	4%
benefit-cost analysis	0%	25%	75%
+development costs	0%	70%	30%
+recreation needs	25%	75%	0%
Familiarization with:			
*water inventories	95%	5%	0%
*land use inventories	94%	6%	0%
+zoning inventories	21%	69%	10%
+census data	15%	60%	25%
+population growth data	11%	65%	24%

Over 90% of the respondents indicated that they believed citizens should be involved in land use decision making by attending public hearings, by joining advisory committees and by maintaining interest in the functioning of local governments.

*Over 50% of the respondents considered topic very important

+Over 50% of the respondents considered topic important

PURPOSE: To participate in group processes that are necessary to solve land-related environmental problems.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Land use responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: Project Learning Tree. Supplementary Curriculum Guide for Grade 7 Through Grade 12. Copyright 1977 by American Forest Institute. Reprinted with permission of AFI.

ACTIVITY: This activity uses a simulation technique to involve students in decision making related to mining on the forest and rangelands surrounding a small community.

Ask the students first to prepare a map of an area 10,000 acres (4,000 hectares) in size, including 25 percent forest and mountains, 25 percent bottomland, 25 percent mountains above the timberline, and 25 percent rangeland. Locate a small community (population 2500) at the foot of the mountains on a stream.

Give your students this background information:

> The community of Wildwood is dependent economically upon a small lumber mill, local tourist trade from forest recreation, and a few small farms and cattle ranches. Its water supply comes from Rimrock Creek which flows past the town. The flow of Rimrock Creek meets the present water needs of the town. Additional water for community expansion could be provided by creating a reservoir, but there are no funds available now to do this.

Coal and oil shale recently were discovered in the foothills, in the forested area, and on some of the best rangeland around Wildwood. Some of this rangeland is a part of a large Indian reservation. A large energy company would like to develop these sources of energy. A committee of local citizens has been chosen to decide whether it would be in the best interest of the community to develop these resources.

Now ask your students to brainstorm a list of individuals whom they believe should be appointed to this committee. Though these people may be given fictitious names, make an effort to generate a list of committee members representing diverse points of view and interest.

PURPOSE: To experience land use decision-making activities.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Land use responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: An Environmental Syllabus: Grades 10, 11, 12. New York State Education Department, pp. 92-95. SE 022 615.

ACTIVITY: The tract of land illustrated on the accompanying map (next page) represents a rural area given to the town of Hillcrest by a family which, for generations, owned the land. Several specific conditions were stipulated in the agreement:

-No more than 20 percent of the land might be sold by the town for single family residences.

-No more than 20 percent of the land might be sold by the town for commercial establishments.

-No more than 10 percent of the land might be sold by the town for apartments and condominiums (each building shall consist of no more than eight units.)

-The remaining 35 percent of the land might be used for commercial recreational areas.

The former owners further directed that the town board appoint a committee of nine local residents to serve on an advisory committee to develop plans for implementing their conditions.

Instruct nine members of the class to serve as members of the advisory committee. The committee should develop plans and ordinances to implement the agreement. Some preliminary calculations should be made before planning begins.

-How many square miles are there in this tract of land? How many square kilometers?

-How many acres are there in the tract of land?

-What is the contour interval?

-Where is there a steep slope? ... a gentle slope?

-Where is the area level?

-What is the elevation of the highest point? the lowest point?

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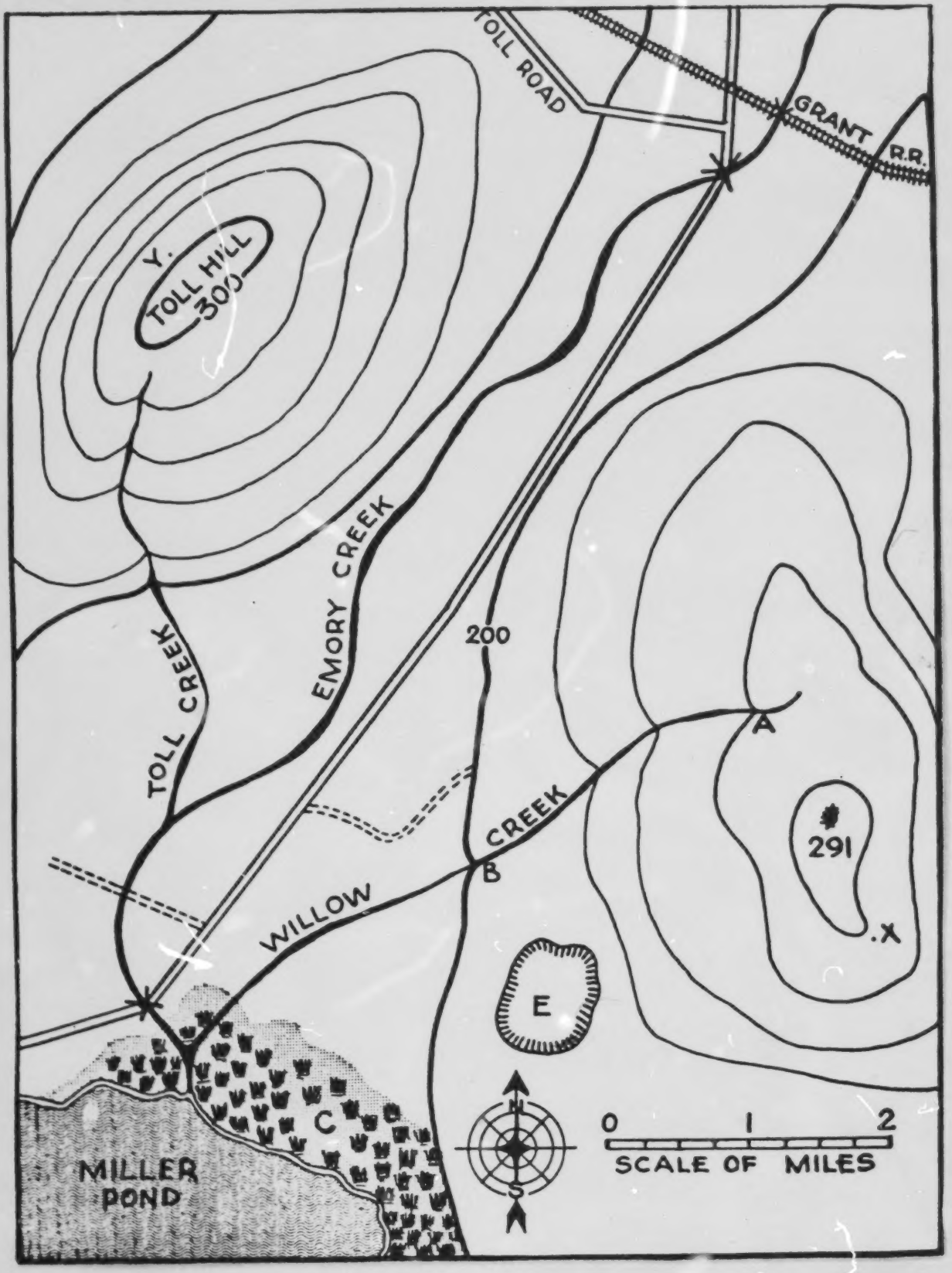
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SCALE OF MILES

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-Where is the location of a hilltop? ... a depression? ... a swamp?

-What is the depth of the depression?

-How do contour lines indicate streamflow?

-How are directions indicated?

-What is the gradient of each of the streams?

Construct several profiles through various areas of the region.

Have the class develop maps of proposed, alternative land uses for the tract which can be made into a coordinated set of overlays for overhead projection and discussion.

The suggestions, compromises, and trade-offs which result from this discussion should be prepared as a report to be submitted to the student "advisory committee." The committee would then either act upon the plans or suggest amendments while returning the plans to the class. (This step must be repeated several times.)

Assign responsibility for preparing a complete, written report of the experience.

PURPOSE: To learn what professionals consider as important tools in land use decision making.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Man has developed techniques useful in describing land and its uses.

REFERENCE: Garlasco, Chris and others, Local Implementation and Land Use Decision Making, Area Cooperative Educational Services, New Haven, CT, Environmental Education Center, 1975. ED 133 216.

ACTIVITY: The information on the following page will be useful in framing an approach to land use management studies. It may be particularly appropriate as an introductory presentation for senior high school students, in that it sets forth key parameters necessary for consideration in land use decision making. Care must be taken that students are not overawed by the variety of topics of concern, but that they see them as indicators of the types of expertise needed. Students must realize that it is unrealistic to expect them to develop such diverse expertise at this point in their studies.

In October 1974, over two hundred individuals directly involved in land use decision making in Connecticut were surveyed to obtain their perspective on the priorities for citizen information about land use. The following table summarizes the results by giving the percentage of respondents indicating each choice.

The information presented in the following table will be useful in framing an approach to land use management studies. It may be particularly appropriate as an introductory presentation for senior high school students, in that it sets forth key parameters necessary for consideration in land use decision making. Care must be taken that students are not overawed by the variety of topics of concern, but that they see them as indicators of the types of expertise needed. Students must realize that it is unrealistic to expect them to develop such diverse expertise at this point in their studies.

	Very Important	Important	Of Limited Importance
General map reading skills			
Ability to interpret:			
*topographic maps	100%	--	--
+bedrock-geology maps	26%	54%	20%
surficial geology maps	15%	45%	40%
*zoning maps	87%	11%	2%
+aerial photographs	14%	65%	21%
*soil survey maps	82%	12%	6%
unconsolidated material maps	9%	25%	66%
Knowledge of:			
+basic soil types	17%	80%	3%
+percolation rates	16%	74%	10%
historical landmarks	13%	37%	50%
+unique habitat	26%	62%	12%
*flood prone areas	80%	17%	3%
+unique vistas	10%	70%	10%
*wetland regulations	78%	20%	2%
*available ground water	81%	17%	2%
+zoning ordinances	31%	65%	4%
condemnation procedures	0%	18%	82%
the taking issue	0%	26%	74%
Riparian rights	0%	9%	91%
+air quality regulations	23%	64%	13%
+water quality regulations	21%	64%	15%
health regulations	61%	35%	4%
tax laws	36%	34%	40%
*septic systems regulations	61%	35%	4%
benefit-cost analysis	0%	25%	75%
+development costs	0%	70%	30%
+recreation needs	25%	75%	0%
Familiarization with:			
*water inventories	95%	5%	0%
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*Over 50% of the respondents considered topic very important

+Over 50% of the respondents considered topic important

PURPOSE: To participate in group processes that are necessary to solve land-related environmental problems.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Land use responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: Project Learning Tree. Supplementary Curriculum Guide for Grade 7 Through Grade 12. Copyright 1977 by American Forest Institute. Reprinted with permission of AFI.

ACTIVITY: This activity uses a simulation technique to involve students in decision making related to mining on the forest and rangelands surrounding a small community.

Ask the students first to prepare a map of an area 10,000 acres (4,000 hectares) in size, including 25 percent forest and mountains, 25 percent bottomland, 25 percent mountains above the timberline, and 25 percent rangeland. Locate a small community (population 2500) at the foot of the mountains on a stream.

Give your students this background information:

> The community of Wildwood is dependent economically upon a small lumber mill, local tourist trade from forest recreation, and a few small farms and cattle ranches. Its water supply comes from Rimrock Creek which flows past the town. The flow of Rimrock Creek meets the present water needs of the town. Additional water for community expansion could be provided by creating a reservoir, but there are no funds available now to do this.

Coal and oil shale recently were discovered in the foothills, in the forested area, and on some of the best rangeland around Wildwood. Some of this rangeland is a part of a large Indian reservation. A large energy company would like to develop these sources of energy. A committee of local citizens has been chosen to decide whether it would be in the best interest of the community to develop these resources.

Now ask your students to brainstorm a list of individuals whom they believe should be appointed to this committee. Though these people may be given fictitious names, make an effort to generate a list of committee members representing diverse points of view and interest.

Committee members might include:

Rancher who holds the mineral rights to some of the coal and oil shale deposits

Sawmill owner

Chamber of Commerce member

Timberland owners, some of whom own the mineral rights on their land and some who do not

Newspaper editor

Banker

Conservation group representative

Local Native American Indian tribe council member

Others?

One group of students is to assume the roles of committee members; another should serve as research staff for the committee; the third and remaining group (the rest of the class) should serve as a city council. Limit the city council group to an odd-numbered size, possibly including a mayor as tie-breaker.

Each student committee member should research and prepare a position statement, stating reasons for supporting or not supporting resource development. Varying degrees of development, as opposed to an all-or-none stand, also may be proposed.

The committee's research staff should be asked to provide information on various issues such as the economic impact on the community; water requirements for oil shale and coal processing; trade-offs involved in committing forest- and rangeland to strip-mining; effects on wildlife; problems involved when the surface rights to the land are held by someone other than the owner of the mineral rights.

The city council should research legal implications of possible decisions they could anticipate the committee to recommend.

The simulation exercise culminates when the committee and its staff reports to the city council with its recommendations and plans for resource development for Wildwood...and the city council "decides."

PURPOSE: To identify advantages and disadvantages related to different methods of land allocations.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Land use policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.

REFERENCE: Project Learning Tree. Supplementary Curriculum Guide for Grade 7 Through Grade 12. Copyright 1977 by American Forest Institute. Reprinted with permission of AFI.

ACTIVITY: Ask your students to make a large-scale map of a publicly owned forest which contains 120 acres (approximately 50 hectares) and these features: a scenic area such as a canyon or meadow; a two-lane highway; a prominent stream with a smaller, tributary creek; a stand of old-growth timer.

Ask each student to assume the role of one of the following individuals or groups who wish to lease a portion of the land:

Timber company executive (40 acres; 15 hectares)

Seven owners of summer cabins (2-1/2 to 3 acres each; 1 hectare each)

Private campground developer (12 acres; 5 hectares)

Mining company executive (20 acres; 10 hectares)

General store and service station owner (2 acres; 1 hectare)

Railroad company executive (a 100-foot-wide right-of-way; 30 meter right-of-way)

Ski resort owner (30 acres; 15 hectares)

Dude ranch operator (15 acres; 5 hectares)

Scenic preservation society (amount of land to be decided by the class after the map is drawn)

Each student, either in a predetermined or random pick-a-number order, chooses a site and marks off the area on the map.

As the land is claimed for each use, students with later choices will find the remaining area insufficient or inappropriate for their needs. Some forest users may be left out entirely.

Ask the class to talk about how the land might be allocated in a better way among those who wish to use it. Attempting to use concensus processes, the class may work out a land-use plan to meet the needs of everyone involved. They might also consider whether there is a need to look beyond the people directly involved in this issue. Are there other possible uses and users not yet represented? What seems to be the most just long-term solution? Have some people given up more than others? What does each person or group give up? What does each gain individually or collectively?

Discuss the merits and drawbacks of the two methods of land allocation: "first come, first serve" or concensus.

Variation

Assume that the forest land is privately owned and each potential user must buy the land he or she requires. (In the first exercise, the land was publicly owned and leased.) Follow the procedures described in the first activity, except when the land "runs out" ask the students to try to re-allocate the amount using a free market system. Land can be exchanged or sold. Some users may decide to sell out and locate elsewhere.

Compare the two methods of allocation identifying the advantages and disadvantages of each. Discuss such ideas as:

Which method seems to create the most controversy, the planning system whereby the land is allocated on the basis of the consensus of the majority or the voluntary system whereby land is allocated on the basis of the individual's ability to pay?

Which system appears to leave the individual owner most satisfied? Explain your response.

Which system appears to be the best for society as a whole? Explain your response.

PURPOSE: To identify compatible kinds of land uses and describe criteria for judging compatibility.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Multiple use is a practice in which a given land area functions in two or more compatible ways.

REFERENCE: Project Learning Tree. Supplementary Curriculum Guide for Grade 7 Through Grade 12. Copyright 1977 by American Forest Institute. Reprinted with permission of AFI.

ACTIVITY: Hold a brainstorming session with your class with the objective of developing four lists relating to land use.

The first list should include personal uses, such as fishing, hunting, hiking, camping, rock climbing, and snowmobiling, which can take place in a forest environment.

The second list should include commercial uses, such as logging and mining.

The third list should include and reflect community values, such as watershed protection, wildlife habitat, and aesthetics, which the same forest might provide.

Focus the fourth list on identifying interest groups that would be likely to represent or promote each of the uses or values mentioned in the first three categories. Examples are motorcycle clubs, environmental groups, hunting and fishing clubs, forest industry organizations, ski-resort owners and developers, and real estate brokers. Ask students to role-play members of these groups as they construct a "conflict matrix."

After conflicts have been identified by the matrix, groups with incompatible self-interests can meet to attempt to work out a solution. While attempting to reconcile their conflicts, students could consider:

Are any of the activities always in conflict or does the incompatibility vary with time and in intensity?

What characteristics of the conflicting activities make them incompatible?

What criteria are you using to determine incompatibility?

Do you believe these conflicts will become more or less frequent in the future? Why?

What must each group be willing to sacrifice in order to reach a compromise?

What are the benefits of each compromise to the interest groups, the individual, the community, the rest of the nation?

Extension

Groups which have worked out solutions to their conflicts may submit their recommendations to actual groups in the community which are experiencing similar conflicts "for real." Ask the community organizations to read and comment on the students' proposals.

Does the students' solution appear to be realistic? If it does not, what are the reasons it won't work?

Students then might revise and resubmit their solutions on the basis of these comments.

PURPOSE: To describe some of the complex factors that go into determining land values.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Multiple use is a practice in which a given land area functions in two or more compatible ways.

REFERENCE: Project Learning Tree. Supplementary Curriculum Guide for Grade 7 Through Grade 12. Copyright 1977 by American Forest Institute. Reprinted with permission of AFI.

ACTIVITY: In this activity, students will attempt to attach values of different kinds (economic, aesthetic, genetic, etc.) to a particular area of forest land.

Divide your class into groups. Ask each group to do research to determine a land value in one of these categories:

Lumber Value - Choose an area of forest land and count the number of trees. Find out from a local resource agency or forest industry representative how to make a rough estimate of the number of board feet yielded per tree and the number that could be obtained from 100 acres (or 100 hectares). Check with a lumberyard to determine the retail price of lumber per 1,000 board feet. Contact a timber company and ask the cost of converting trees to 1,000 board feet of lumber and transporting the product to the lumberyard. Subtract this amount from the retail price quoted by the lumberyard. What might this 100 acres (or 100 hectares) of forest be worth in dollars for lumber? Note: This figure does not take into account marketable byproducts; for example, particle board or pressed wood logs.

What might be the value of this forest land and its lumber other than as measured in dollars; for example, ask source of inspiration and solitude.

Watershed Value - Discuss the concept of a watershed and the ways in which a forest affects the amount of water available in an area.

Using the same 100 acres (or 100 hectares) as the sample, check the amount of rainfall in that area and calculate the rainfall on 100 acres (or 100 hectares). Amount of rain in feet X 43,560 square feet/acre = cubic feet of water/acre X 7.5 gallons/cubic feet of water = gallons of water falling on 1 acre. Amount of rain (in meters) X 10,000 square meters = cubic meters of water/hectare ÷ 100 = water falling on 1

hectare. From the local water company, find out the money value of 1,000 gallons of water (or cubic meters). What is the money value of the amount of water that fell on the sample plot?

From the U.S. Weather Service or your local Soil Conservation Service find out what percent of the rainfall they estimate does do into sources (aquifers, streams, etc.) available for human consumption. How would this compare with the same amount of rainfall, falling on a plot of the same size in open prairie, for example?

Calculate approximately what the forest is worth economically to people as a watershed. Attempt to calculate what the forest is worth as a watershed to living things other than people.

Wildlife Value - Find out what types of wildlife inhabit this forest land. How many animals and birds? Are there any, such as deer, turkey, or quail, which are hunted by humans? Determine how much money hunters spend locally on licenses, guns, ammunition, equipment, lodging, travel, and guides. Include any forms of nonconsuming uses related to wildlife (photography and bird watching, for instance) that generate economic income in this area. What is the total wildlife value (as measured in dollars) of this land? Describe the wildlife value of this land other than in dollars; for example, as a gene pool for future generations.

Recreational Value - Determine what forms of recreation take place in the forest. Find out what camping or parking charges are levied per day. How many people use this forest for camping or other recreation, and how much money do they spend in the area? What is the total recreational value measured in dollars? What recreational value in the forest are not easily measured in dollars? Note: The forest's intangible values of wildlife, meteorological influences, and aesthetics may be harder to calculate but are nonetheless real and worthy of consideration. In each of the sections above, ask the students to invent other ways to determine value other than dollar income.

Forage Value - Determine whether cattle or sheep could use this land for grazing. How many animals could it support? How much are the animals worth on today's market? What are the total forage values? Economic and other values?

After all the information has been collected, researched, and shared by the class, lead a discussion. Students may not be able to resolve the issues involved, but they may become aware of the complexities of land-use management. Consider specific questions such as:

If the community wanted to clear this 100 acres (or 100 hectares) of forest in order to build homes, provide farm sites, or put in a highway, how would the proposal influence the land's value? Decide which uses make the land more valuable. To whom? Specify how you are measuring value. Find another way to measure value. Does your answer change?

Decide whether the various values determined for this 100 acres (or 100 hectares) could be applied to other areas of the same size but of different forest types. Specify what variables might make a difference in the economic, or the "intangible," values of the area, and from whose viewpoint.

Decide which uses make the land more valuable in the long run, specifying from whose point of view, and by what means the value is measured.

What trade-offs are involved when we convert forest land from multiple use or a few dominant uses? Society needs houses, farms, and roads, but we also need forests. Decide whether and how we can have them all. Find out who determines the uses of forest land.

*Students may find any of the following to be useful in their research:

Newspaper advertisements

Water company/municipal waterworks

Local lumber businesses and foresters

U. S. Soil Conservation Service

U. S. Weather Service

State Department of Wildlife or a similar agency

U. S. Forest Service

State Department of Recreation/Parks or a similar agency

Citizen conservation groups

PURPOSE: To consider the role of state legislatures in determining land use management policies.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Land use responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: Shaefer, Larry. State and Federal Implementation, Area Cooperative Educational Services, New Haven, CT, Environmental Education Center, 1975, ED 133 217; A Legislator's Guide to Land Management, The Council of State Governments, Iron Works Pike, Lexington, KY 40511, 1974.

ACTIVITY: What are the important legislative issues in land use management? Should the concern be with the process? Should policy be a major consideration?

There are no set answers. Each State has its own unique situation providing the light under which the proposal should be viewed. However, there are certain questions which will illuminate the consideration of any proposal. In attempting to offer a word of guidance, the following questions are offered:

Who establishes policy at the various levels of government?

How far does the Legislature go in dictating policy?

Who is responsible for converting that policy into a working plan?

What role should the legislator play in molding public opinion in respect to land use?

What state efforts for improvement will be acceptable to the citizens of the State?

Will the proposed legislation resolve the inadequacy of existing laws?

Does the proposed legislation fulfill all legal requirements-state, federal and constitutional?

Which is the proper agency to administer the program?

Will there be sufficient funds available to support the program?

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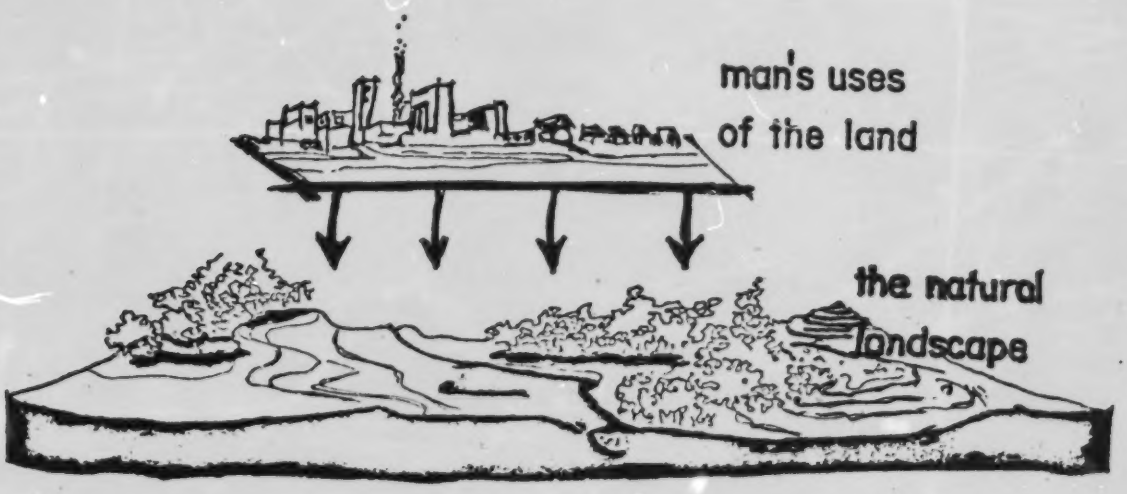
Will there be adequate manpower available to accomplish the job?

Is the proposed mechanism adequate to anticipate future needs so that potential problems are resolved before they happen?

What alternatives have been considered, and by whom?

What irreversible environmental changes will be made to the land?

Should land be specifically set aside and preserved intact for future generations?"



PURPOSE: To understand the role of the federal government in management of public lands.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Land use responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: The Fifth Annual Report of the Council on Environmental Quality, 1974, and The Sixth Annual Report of the Council on Environmental Quality, 1975, U.S. Government Printing Office.

ACTIVITY: "To a citified easterner accustomed to thinking of land as either public park or someone's private property, the idea of public lands may seem out of the ordinary. Not so to most westerners. To ranchers whose cattle graze on public range, or campers who sleep in National Forests, or prospectors who stake claims for copper or uranium on the public domain, the fact that one-third of the land in the United States belongs to all its citizens comes as no surprise.

"In the lower 48 states, 17 percent of the land is publicly owned. Alaska is a separate case--until statehood, the federal government owned 95 percent of the land. Even after land transfers to the state and to Alaskan natives are completed, one-half of Alaska will still be federally owned."

Students should investigate the status of federal ownership of land in their own and neighboring states; Table 1 (pp. 201, 202) displays 1973 data for all states.

Table 2 (p. 203) indicates general land use patterns in the United States, 1950-1970, as well as listing acreages managed by federal agencies. Several sets of appropriate investigations may be made:

1. Students should report on land management responsibilities and policies of the various agencies, such as Bureau of Land Management, Forest Service, Park Service, Fish and Wildlife Service, Department of Defense, Army Corps of Engineers, Bureau of Reclamation, Tennessee Valley Authority, and Bureau of Indian Affairs. Various volumes of the Annual Report of the Council on Environmental Quality will provide some information; local offices of such agencies, as available, will supply further information. Addresses of national offices are listed below:

Bureau of Land Management
Department of the Interior
Washington, DC 20240

U.S. Forest Service
Department of Agriculture
Washington, DC 20202

National Park Service
Department of the Interior
Washington, DC 20240

U.S. Fish and Wildlife Service
Department of the Interior
Washington, DC 20240

Department of Defense
The Pentagon
Washington, DC 20301

Corps of Engineers
Department of the Army
Washington, DC 20314

Bureau of Reclamation
Department of the Interior
Washington, DC 20240

Tennessee Valley Authority
Norris, Tennessee 37828

Bureau of Indian Affairs
Department of the Interior
Washington, DC 20240

2. Investigations of federal land holdings and land management policies within the class' home state may be made. How the federal government, and its agencies, came to own the land, why they retain it, and for what purposes it is managed are all pertinent areas of concern.

   Determinations of which agencies manage what acreages, and where, within the state presents an appropriate mapping exercise. Such information is generally available from local offices of federal agencies, or from state agencies such as Departments of Natural Resources, etc.

TABLE 1

TOTAL ACREAGE AND FEDERALLY OWNED ACREAGE, BY STATE, 1973*
(In thousands of acres)

State	Total Acreage	Not Owned by Federal Government	Owned by Federal Government	
			Area	Percent
Alabama	32,678	31,569	1,109	3.4
Alaska	365,482	12,098	353,384	96.7
Arizona	72,688	40,754	31,934	43.9
Arkansas	33,599	30,420	3,179	9.5
California	100,207	55,135	45,072	45.0
Colorado	66,486	42,547	23,939	36.0
Connecticut	3,135	3,126	9	0.3
Delaware	1,266	1,227	39	3.0
District of Columbia	39	29	10	26.2
Florida	34,721	31,295	3,426	9.9
Georgia	37,295	35,090	2,205	5.9
Hawaii	4,106	3,689	417	10.2
Idaho	52,933	19,201	33,732	63.7
Illinois	35,795	35,237	558	1.6
Indiana	23,158	22,683	475	2.1
Iowa	35,860	35,636	224	0.6
Kansas	52,511	51,810	701	1.3
Kentucky	25,512	24,199	1,313	5.1
Louisiana	28,868	27,814	1,054	3.7
Maine	19,848	19,717	131	0.7
Maryland	6,319	6,121	198	3.1
Massachusetts	5,035	4,956	79	1.6
Michigan	36,492	33,100	3,392	9.3
Minnesota	51,206	47,852	3,354	6.6
Mississippi	30,223	28,646	1,577	5.2

*From the Sixth Annual Report of the Council on Environmental Quality. pp. 449-450.

TABLE 1--Continued

State	Total Acreage	Not Owned by Federal Government	Owned by Federal Government[1]	
			Area	Percent
Missouri	44,248	42,189	2,059	4.7
Montana	93,271	65,523	27,648	29.6
Nebraska	49,032	48,340	692	1.4
Nevada	70,264	9,432	60,832	86.6
New Hampshire	5,769	5,059	710	12.3
New Jersey	4,813	4,683	130	2.7
New Mexico	77,766	51,899	25,867	33.3
New York	30,681	30,452	229	0.7
North Carolina	31,403	29,458	1,945	6.2
North Dakota	44,452	42,157	2,295	5.2
Ohio	26,222	25,895	327	1.2
Oklahoma	44,088	42,574	1,514	3.4
Oregon	61,599	29,376	32,223	52.3
Pennsylvania	28,805	28,154	651	2.3
Rhode Island	677	669	8	1.2
South Carolina	19,374	18,233	1,141	5.9
South Dakota	48,882	45,598	3,284	6.7
Tennessee	26,728	24,954	1,774	6.6
Texas	168,218	165,044	3,174	1.9
Utah	52,697	17,831	34,866	66.2
Vermont	5,937	5,667	270	4.5
Virginia	25,496	23,153	2,343	9.2
Washington	42,694	30,118	12,576	29.5
West Virginia	15,411	14,356	1,055	6.8
Wisconsin	35,011	33,204	1,807	5.2
Wyoming	62,343	32,275	30,068	48.2
United States	2,271,343	1,510,344	760,999	33.5

[1]Excludes trust properties.

Source: General Services Administration, Inventory Report on Real Property Owned by the United States Throughout the World as of June 30, 1973 (Washington, D.C.: Government Printing Office, 1974).

TABLE 2

U.S. LAND USE AND GOVERNMENT OWNERSHIP, 1950-70*
(in acres)

Land Use			
Land Area (million)			
Total	2,273	2,271[1]	2,264[2]
Farm	1,162	1,124[1]	1,064[3]
Grazing land[3]	402	319[1]	288[3]
Forest land not grazed	368	438[1]	475[3]
Other[4]	341	390[1]	437[3]
Park Area (thousands)			
Total	29,137	32,321	38,064
National Parks	23,836	25,704	28,543
State Parks[5]	4,657	5,602	8,555
County and municipal parks	644	1,015	966
Federally owned land (million)			
Total[6]	754[7]	772	762
Bureau of Land Management	NA	500	474
Forest Service	180	186	187
Park Service	23.8[7]	25.7	28.5
Fish and Wildlife Service	7[7]	16	28
Department of Defense[8]	30	31	31
Civil Works[9]	NA	15	16
Other[10]	NA	7	8

[1]1959 data.

[2]1969 data.

[3]Includes grasslands, arid woodlands, and other forested land grazed.

[4]Includes urban, industrial, and residential areas, rural parks, wildlife refuges, highways, railroad rights of way, ungrazed desert, rocky barren and swamp land, tundra and other land.

[5]Excludes state forests, wildlife refuges, and waysides not administered by state park agencies.

[6]Excludes outlying area beginning in 1960.

[7]1955 data.

[8]Army (excluding Corps of Engineers), Navy and Air Force.

[9]Corps of Engineers and Bureau of Reclamation.

[10]Atomic Energy Commission, Tennessee Valley Authority and Bureau of Indian Affairs.

NA: not available

*From The Fifth Annual Report of the Council on Environmental Quality, p. 340.

Sources: U.S. National Park Services, Areas Administered by the National Park Service, semiannual; U.S. Bureau of Outdoor Recreation, State Outdoor Recreation Statistics—1962 (1963); National Recreation and Park Association, Arlington, Va., State Park Statistics, 1970, Parks and Recreation (1971), and Recreation and Park Yearbook; General Services Administration, Inventory Report on the Real Property Owned by the U.S. Throughout the World, annual; and U.S. Department of Agriculture, Economic Research Service, Agricultural Statistics, annual, as cited in U.S. Bureau of the Census, Statistical Abstract of the United States, 1973 (1973), Tables 323, 328, 329, and 983.

PURPOSE: To determine the historical influence of survey systems on land use.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Man has developed techniques useful in describing land and its uses.

ACTIVITY: A determining factor in development of land use patterns has been the type of land survey system employed in description of property ownership, particularly in terms of governmental disposal of public lands. The two basic systems employed in the United States are the Township and Range System and the Metes and Bounds System.

The Township and Range System was adopted by the federal government in 1785 to facilitate description and disposal of public lands, and was used primarily in those areas not settled at that time. Land is described in reference to a network of north-south lines (principal meridians) and east-west lines (base parallels). In effect, the land is divided into north-south strips six miles wide, numbered east and west of the most convenient (predetermined) principal meridian. These are called ranges. The ranges are divided into townships by east-west lines six miles apart, beginning at the most convenient (also predetermined) base parallel. (See Figure 1). Thus, a township is 36 square miles in area.

T.2N., R.2W.	T.2N., R.1.W.	T.2N., R.1E.	T.2N., R.2E
T.1N., R.2W.	T.1N., R.1W.	T.1N., R.1E.	T.1N. R.2E.
T.1S., R.2W.	T.1S., R.1W.	T.1S., R.1E.	T.1S., R.2E.
T.2S., R.2W.	T.2S., R.1W.	T.2S., R.1E.	T.2S., R.2D.

Base Parallel

Principal Meridian

Figure 1.--The Township and Range System.

By this system, any township may be located by reference to its township and range numbers (viz., township 3 north, range 5 east, normally abbreviated T. 3 N., R. 5 E.). Because meridians converge to the north, because some base lines are not true east-west, because errors may occur in surveying, and because lakes and streams may be present at critical points, corrections and allowances must sometimes be made.

Townships are divided into 36 sections, each one square mile (640 acres) in area. The numbering system for sections is shown in Figure 2. To provide more detailed location and description, each section may be divided into quarters, each having an area of 160 acres. The quarter sections are subdivided into "quarter-quarters" of 40 acres each, commonly called "forties."

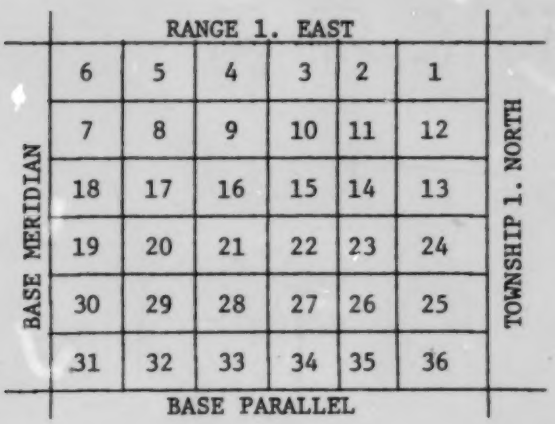


Figure 2.--The 36 sections of T.1 N., R.1 E.

To describe a specific forty, one might say that it is the SW 1/4 of NW 1/4 of Sec. 7, T. 4 S., R 6 W. (Figure 3).

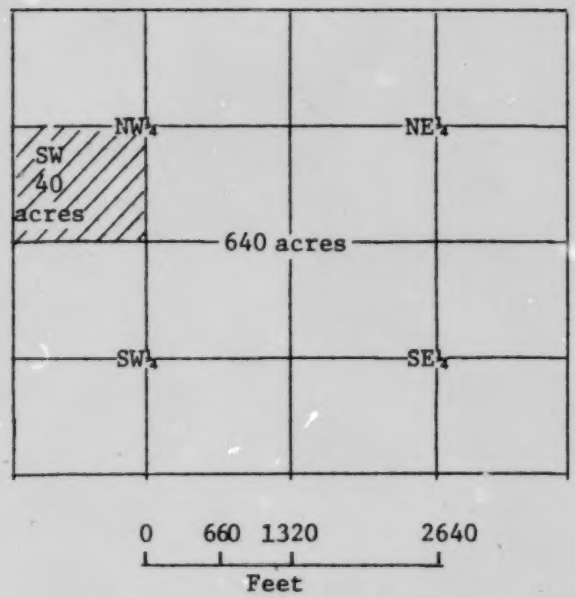


Figure 3.--The description and location of parts of sections under the rectangular survey, is by quarter sections, and within these, by 40-acre tracts, designated by the compass position of each within its quarter section.

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The Metes and Bounds System describes land parcels in states where the original land grants and surveys were made before the township and range system was adopted; this includes the Atlantic Coast states and Texas. An arbitrary starting point is selected, such as a tree, a boulder, or a significant point on the edge of a body of water. Boundary lines are determined along a measured line in any compass direction deemed appropriate to a second key point, from which another compass direction is struck to a third point, and so on around to the point of origin. Among complications of this system are frequent loss of markers of key points, inexact measurement of distances, and lack of consistent patterns of shape with reference to the cardinal points of the compass.

Parcels identified under the metes and bounds system may be rectangular, but are generally long and narrow. The narrow frontage is often on a river, with the length often at right angles to the river, regardless of river direction. This is an indication of the value associated with river frontage, and the lesser value of interior lands, at the times of the original surveys. Variants of the metes and bounds system are still common in much of Europe, as in most of the rest of the world.

A determination should be made of which of these systems was utilized in the original description of local lands. (Publications of state geological surveys, or similar agencies, are very helpful.) Certain evidence of the type of system may be readily apparent; for example, road patterns under the township and range system generally follow property lines, and thus are at right angles to one another, whereas under the metes and bounds system they are more likely to be irregular. Topographic maps, oil company maps or aerial photographs may be of help here.

List and discuss advantages and disadvantages of each system. How did the system employed in the local area aid in its development? How did it hinder development, if it did?

Why was the metes and bounds system appropriate to its time in American history? Why is it still used in much of the rest of the world?

For what reasons was the township and range system instituted by the newly-formed American government in 1785? Has history demonstrated that it was the appropriate choice? Why, or why not?

An interesting set of conjectures may be developed around a consideration of what might have happened in terms of development of the local area, had the other system been the one employed in the original surveys. Would the other system have been "better?" or "worse?" Why?

PURPOSE: To investigate cemeteries from a land use perspective.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Multiple use is a practice in which a given land area functions in two or more compatible ways.

REFERENCE: Junglas, Mary, et al. Environmental Learning Experiences, Bio-Physical, Senior High School. Center for the Development of Environmental Curriculum, Willoughby-Eastlake City Schools, Willoughby, Ohio, 1974. ED 099 230.

ACTIVITY:

1. Class might determine the total acreage in the community devoted to burying the dead. Comparisons may be made with past acreages, and projections made into the future.

2. Interview cemetery managers. Determine the following:

   a. Who is buried where—wealthy, poor, white, black?

   b. How is the cemetery used now, besides for burial?

   c. Would the managers be receptive to other uses? Recreation, wildlife sanctuary, biking paths?

3. What values clashes are apparent in attempts to use cemeteries in other ways? Discuss how they might be resolved.

PURPOSE: To understand the influences of land disposal and conservation policies on our nation's history.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Land use policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.

REFERENCE: An Environmental Syllabus: Grades 10, 11, 12, New York State Education Department. ED 139 671. 111 Significant Federal Laws Concerning Natural Resources and Environment and the Creation of Federal Agencies, School of Natural Resources, The Ohio State University. (Abstracted in Appendix A, pp. 233-237.)

ACTIVITY: During the first century, and well into the second, of America's existence as a nation, disposal of federally-owned lands was a major goal, the objective of development being a major factor. Many different laws were enacted providing for various means of disposal. It has sometimes been said that there are more than five thousand land laws. There are indeed a relatively large number of land disposal laws, but the great majority of them are private land measures in the sense that each relates to a specific tract of land. But there are perhaps a hundred or more land laws of more-or-less general applicability still on the statute books. (A standard reference is Digest of Public Land Laws, U.S. Government Printing Office.)

Students should outline and explain the significant legislation in United States history which has affected the use and disposal of public land. A "short," and necessarily incomplete, list of such laws includes:

1. Homestead Law of 1862
2. Agricultural College Act—Land Grant-in-Aid of Colleges, 1862 (The Morrill Act)
3. Yellowstone Park Protective Act of 1872
4. General Mining Law of 1872
5. Desert Land Act of 1877
6. Timber and Stone Act of 1878
7. Geologic Survey Act of 1879
8. Forest Reserve Act of 1891
9. Antiquities Act of 1906
10. Mineral Leasing Act of 1920
11. Wheeler-Howard Act of 1934
12. Taylor Grazing Act of 1934
13. Historic Sites Act of 1935
14. Wilderness Act of 1864

15. Land and Water Conservation Fund Act of 1964
16. Public Land Law Review Commission Act. Classification and and Multiple Use Act, Public Sale Act of the 88th Congress, 1964.

Among focal points for discussion are:

1. Do these legislative acts reflect a national commitment to wise use of the nation's lands? Explain.

2. How has the nation, during its history, used disposal of public lands as a device to encourage the nation's development?

3. How have federal policies with respect to land disposal reflected our national commitment to "manifest destiny"?

4. How have national policies with respect to federal land disposal and use shifted over time?

PURPOSE: To develop ideas and opinions about planning for wise use of land in a given community.

LEVEL: 10-12

SUBJECT: Social Studies

CONCEPT: Physical characteristics of the natural environment are of major importance in determining land use.

REFERENCE: Jamason, Barry W. Environmental Quality: A Community Concern, New York State Department of Education.

ACTIVITY: You will need copies of the four worksheets (found at the end of the activity) for each student.

Provide class members with copies of Worksheet 1. This worksheet contains important facts and generalizations concerning land use in the United States. The information will be useful as students develop their own ideas and opinions about planning for wise use of the land.

Obtain a map of the community which illustrates, among other things, remaining vacant land. Duplicate and provide copies to the students. Introduce the planning activity of this seminar by describing the following hypothetical situation:

> Our community, faced with a rapidly increasing rate of growth in the coming years, has decided it must make some decisions about the best use of remaining vacant land. You are part of a committee which is evaluating new zoning laws and planning for local land use regulations. You are particularly interested in considering the best uses for one undeveloped piece of land in your community which has become the center of controversy over future use.

Divide the class into groups, each assigned to pick a different use for the same parcel of land. Assign an adversary role to one or more members of each group. For example, if the group decides to build a park, assign one member of the group to be the "owner" of the land who wants to sell it to a developer so that he can retire from his job; or, one member to be an inner city resident who needs public housing that can be built on that spot.

Distribute Worksheet 2 among the small groups in order that each group may develop its findings in an independent yet parallel fashion. The gist and sequence of the questions will give form and substance to each small group's set of conclusions.

As each group reaches its conclusions about wise use of its land parcel, suggest that the members consider what will be the impact of their decision. A brief examination of Worksheet 3 will enable them to anticipate some of the questions that might be asked in an authentic land-use planning situation. In this connection, appoint a review committee, selecting a member from each group, to evaluate each group's decision in the light of the impact of each decision.

> How many of these land use plans would the committee approve, given these impact considerations?

An alternative, more objective means of assessing impact would be to use the chart which is provided as Worksheet 4, using the following instructions:

> Use the chart to emphasize the concept of environmental impact.
>
> Substitute project descriptions across the top of the chart as necessary. Areas of impact are listed in the left-hand column. Ask students to fill in the chart using the symbols as in the examples below:
>
> + = a beneficial effect is anticipated for the environmental characteristic noted; e.g., improved transportation (11.) under column (H), airport expansion.
>
> - = an adverse environmental effect is anticipated; e.g., noise levels (3.) increase and thus are adversely affected under column (H), airport expansion.
>
> 0 = no appreciable change anticipated; e.g., water table (8.) under column (H), airport expansion.

Once decisions have been made for every impact feature in a project column, a simple comparison of + and - responses will suggest whether or not the project seems feasible. Many students will wish to qualify some of their decisions, particularly those using the symbol 0. Comments of this nature may be added on another sheet by simple references such as H.11., H.3., H.8.

LAND USE WORKSHEET 1 - LAND USE DATA

Like all advanced nations, the United States is using land more extensively than ever before. Certain kinds of land resources are becoming scarce--land within a reasonable distance of urban centers available for housing, recreation, and waste disposition; land within cities that can be used for transportation, networks, parks and open space; and land to accommodate commercial facilities, housing, and centers of higher education. At the same time, we must conserve valuable farm land in order to provide food, feed, and fiber for our still expanding population and world markets.

Some salient facts:

--4 billion tons of sediment are washed into streams annually as a result of land misuse.
--1,687,288 acres of wildlife habitat have been destroyed by surface mining.
--3,187,825 acres of land have been despoiled by surface mining.
--17,197,531 acres of wetlands have been destroyed in seven states alone. (45.7 percent of the wetland area of Arkansas, California, Florida, Illinois, Indiana, Iowa, and Missouri).
--25 million tons of logging debris are left in forests every year.
--4 million acres of right-of-way are traversed by over 300,000 miles of overhead transmission lines.
--1 million (approximately) acres of forests are clear-cut annually.
--4 billion tons of raw materials are consumed annually in U.S. production, most of which are eventually disposed of as waste on the land.

Our intensive and consumptive use of the land is expected to escalate dramatically in the next 27 years. In fact, all that has been built in the history of this Nation may have to be duplicated. That is, the equivalent of every school, pipeline, power-plant, office building, airport, shopping center, factory, home, and highway that has been built during our first 200 years may have to be matched to accommodate population and market demands projected for the year 2000.

Here are some conservative projections for land use in the U.S. over the next generation.

--19.7 million acres may be consumed by urban sprawl by 2000--an area equivalent to the states of New Hampshire, Vermont, Massachusetts, and Rhode Island.
--3.5 million acres may be paved over for highways and airports by 2000.

--7 million acres may be taken from agricultural use for recreation and wildlife areas by 2000.
--5 million acres may be lost to agriculture for public facilities, second home development, and waste control projects by 2000.
--492 power stations may be built be 1990, many of them requiring cooling ponds of 2,000 acres or more.
--2 million acres of the right-of-way may be required by 1990 for 200,000 additional miles of power lines.

It will be up to the people and their elected representatives to decide whether the land is to be employed in this way, but presently there is no adequate mechanism to plan or control land use.

LAND USE WORKSHEET 2 - PLANNING CHECKLIST

What is the projected population growth rate in your community?

What is the anticipated industrial and commercial growth? What planning is being done to provide for this growth?

Has your community inventoried and/or controlled any special areas that would be particularly damaged by high density occupancy? For example, historic sites, cultural assets, unique ecological community, etc.

Is your community benefitting from your state's Agricultural Districting Law, by which a farmer can apply for an agricultural value assessment on his land, thus reducing his taxes and relieving the pressure to sell to developers? Does your state have such a law?

Does your community have a comprehensive land use plan? Is this plan adhered to? Whose responsibility is it to implement the plan? What are the qualifications of the planning commission?

Is there at least one qualified environmentalist on this board?

What specific laws are in effect to prevent building in flood plains; to control land erosion; to prevent unnecessary clearing of trees and other vegetation; and, to control diversion and other tampering with streams?

Does the Zoning Board consult the Watershed Association involved, or the County Planning Board, as to the effect of its decision on the watershed. If not, why not?

Does the zoning law encourage cluster housing?

What provisions have been made, or are pending, to ensure the continued existence of open land areas in your community?

Does the present tax structure "discriminate" against owners of open land?

- -Has any consideration been given to tax relief for owners of open land, in order to make it easier to retain it as open land?
- -Could such tax relief be considered?
- -When and how could such a proposal be initiated?

Are there laws or regulations controlling the extent to which land may be covered with impermeables? Who is charged with enforcement?

What flood control measures exist? How are these maintained and by whom?

LAND USE WORKSHEET 3 - LAND USE IMPACT DISCUSSION

Use the following questions as a guide for considering some of the impact your plans will have upon the adjacent land, the community at large, and nearby communities. Consider both short-term and long-term impact. Be as specific as possible. Consider what resources in your community you could use to find the answers to difficult questions.

Air Pollution

Will this use cause additional air pollution in your community? Consider the immediate concentration of the air pollution as well as overall air quality.

Who will be affected by this air pollution?

Is the area in which the land is located already affected by air pollution problems?

Water Quality and Management

Will this use affect the water table and/or long-term water supply needs of the area?

How will this use affect water quality?

Will this use have any effect on flooding?

Is any area going to be paved over, thus causing run-off and flooding, rather than seepage into the water table?

Transportation

Are current transportation facilities sufficient for people to get to the land in question?

Will this cause an increase in traffic congestion?

Can a mass transit mode be used?

Noise

Will this use cause increased noise pollution during and after its construction?

Growth

Will this use encourage residential, commercial and/or industrial growth in your community? How?

LAND USE WORKSHEET 4 - PROJECT IMPACT

Project → / Impact ↓	A. Sewage Treatment Plant	B. Highway Construction	C. Apartment Complex	D. Tract Housing	E. Shopping Center	F. Nuclear Power Plant	G. Zoning Change: Commercial to Agricultural	H. Airport Expansion
1. Air Quality								
2. Water Quality								
3. Noise Levels								
4. Natural Habitats								
5. Mineral Deposits								
6. Solid Waste								
7. Contaminants (radioactive; chemical, etc.)								
8. Water Table								
9. Topography								
10. Aesthetic Quality								
11. Transportation								
12. Scenic Areas								
13. Economic Condition								
14. Population Density								
15. "Quality of Life"								

PURPOSE: To understand the "conservation ethic."

LEVEL: 10-12

SUBJECT: Social Studies
Language Arts

CONCEPT: We have "legal" ownership of some land resources like real estate and control over others during our lifetime, but ethically we are "stewards" rather than owners of the land.

REFERENCE: An Environmental Syllabus: Grades 10, 11, 12. New York State Education Department, pp. 86-87. ED 139 671.

ACTIVITY: A major concern relating to environmental quality in general, and certainly to land use, is the consideration of the "ecological conscience"---that is, over and above requirement and legality, what are the ethical aspects of use and misuse of environment? The question has been explored on many levels, from Congress to classroom to pulpit. One of the problems confronting the educator is, "How might the necessity of an environmental ethic be communicated without preaching or brainwashing?"

A number of writers have developed clear statements of the need for a land use ethic which will be meaningful reading for the high school student. Among them are:

Garrett Hardin, 1968, "The Tragedy of the Commons," Science 162:1243-1248.

Aldo Leopold, 1949, A Sand County Almanac, Oxford, New York.

Stewart L. Udall, 1963, The Quiet Crisis, Holt, Rinehart, and Winston, New York.

All three of the above, and a number of other titles discussing "the conservation ethic," are available in reprint and paperback from several sources.

Using readings such as these as background, questions such as the following may be addressed:

1. How did early American Indians demonstrate a lifestyle compatible with the environment?

2. Contrast the uses of land by American Indians before European settlement of the New World with the land use practices of early American settlers. What generalizations might be drawn?

3. How did differences in land use practices and "conservation ethics" contribute to conflict between early American settlers and Native American Indians?

4. Does a conservation ethic currently exist in this country, to the extent that sound land use planning and management will occur? Explain.

5. How can privately owned land be managed in the public interest? Should it be?

PURPOSE: To make a plan for a recreation area.

LEVEL: 10-12

SUBJECT: Math
Social Studies

CONCEPT: Esthetic resources and recreational facilities of economic and non-economic value are becoming increasingly important in leisure-time activities.

REFERENCE: Fox, Charles E. Activities for Teaching Forest Conservation: Grades 10-2nd Year College, Forest Service, U.S. Department of Agriculture, June, 1958.

ACTIVITY: This project is a constructive activity in that recreation policy must be formulated and problems of objectives, population growth, etc., considered in practical terms. The idea is to "start from scratch" with an hypothetical area, make a simple map, and develop a plan for use. Begin with a discussion of recreation objectives, different types of developments, needs of the future, analysis of specific areas known to the class, either locally or encountered on vacation trips.

a. Select an area in the vicinity that has potential for development as a public picnicground and campground, and--if suitable water is present--for bathing, boating, and fishing. Assume that funds are available for purchase, or that the land can be obtained by donation. One area can be selected as a project for the whole group, or individuals or "committees" can select their own.

b. It might be well for the "planner" first to ask himself certain orientation questions: Who will use the area? When? Will timber be cut, and if so, how much, where, and with what protection of recreation and scenic values? How much road construction? What structures? Of the many uses to which the area may be put, which shall receive priority? Swimming? Picnicking? Baseball? Shall any portions be left undisturbed? Where? As such questions are considered, the planner will develop the general feeling that he believes should be caught and preserved in the development. He is then ready to make the preliminary map and writeup.

c. Map. A map on the scale of at least 8 inches to the mile will be necessary in order to show the necessary detail. Some of the students will understand the use of plane table or compass and pacing, and if it is decided to use one area for the whole class, perhaps these "mappers" could lead the group in making a map which could be used as a base by the entire class; as a substitute, a sketch map approximately to scale, with distances estimated, will have to do.

Prepare a rough working copy of a map on which changes can be freely made. A simple legend for topographic and cultural features is a necessity. Probably the best source for a legend is the sheet "Topographic Map Symbols," free on application to the Director, U.S. Geological Survey, Washington D.C. 20025. One copy will do for the class. For area developments such as tent sites, float, campfire circle, not found in conventional legends, use original symbols that suggest the subject. The accompanying map of a recreation area should be helpful (Figure 1).

Improvements that might be shown on the map and in the plan: roads (main, secondary, and service); bridges; trails; camp areas; picnic areas; beaches; trailer sites; summer home sites; organization campsites; store, other concessions; observation tower; docks; playground area; sanitary facilities; water supply facilities; fences; entrance signs; bulletin boards; shower and wash houses. (There may be a tendency to include too much.)

After the final draft of the following written section ("d") is prepared, the final map can be drawn.

d. Written section of plan. This will consist of 2 parts: (1) General policy; (2) Discussion of individual units or improvements. A preliminary draft should be made first.

(1) General Policy

Purpose of area; objectives; policy regarding timber cutting, livestock grazing, signs, road construction; priority of types of use; fire protection; cooperation with other agencies; hunting and fishing; open fires; length of stay; fees charged; others not listed.

(2) Individual units or improvements

For each type of improvement, seperately and briefly discuss standards of construction; number of units and capacity, if applicable; sanitary precautions; restrictions; plans for maintenance, garbage removal, etc.; patrolman or supervisory guard. If initial construction is only for a portion of the total planned, indicate which units will be completed first, and which later, assigning appropriate years.

e. Discussion and evaluation. Compare the different plans as to practicality, effectiveness in meeting the needs, innovations in approach. Let the planners defend their proposals. Summarize by bringing together the best features introduced. Are there any opportunities for new recreation areas, or for improving existing areas in your community?

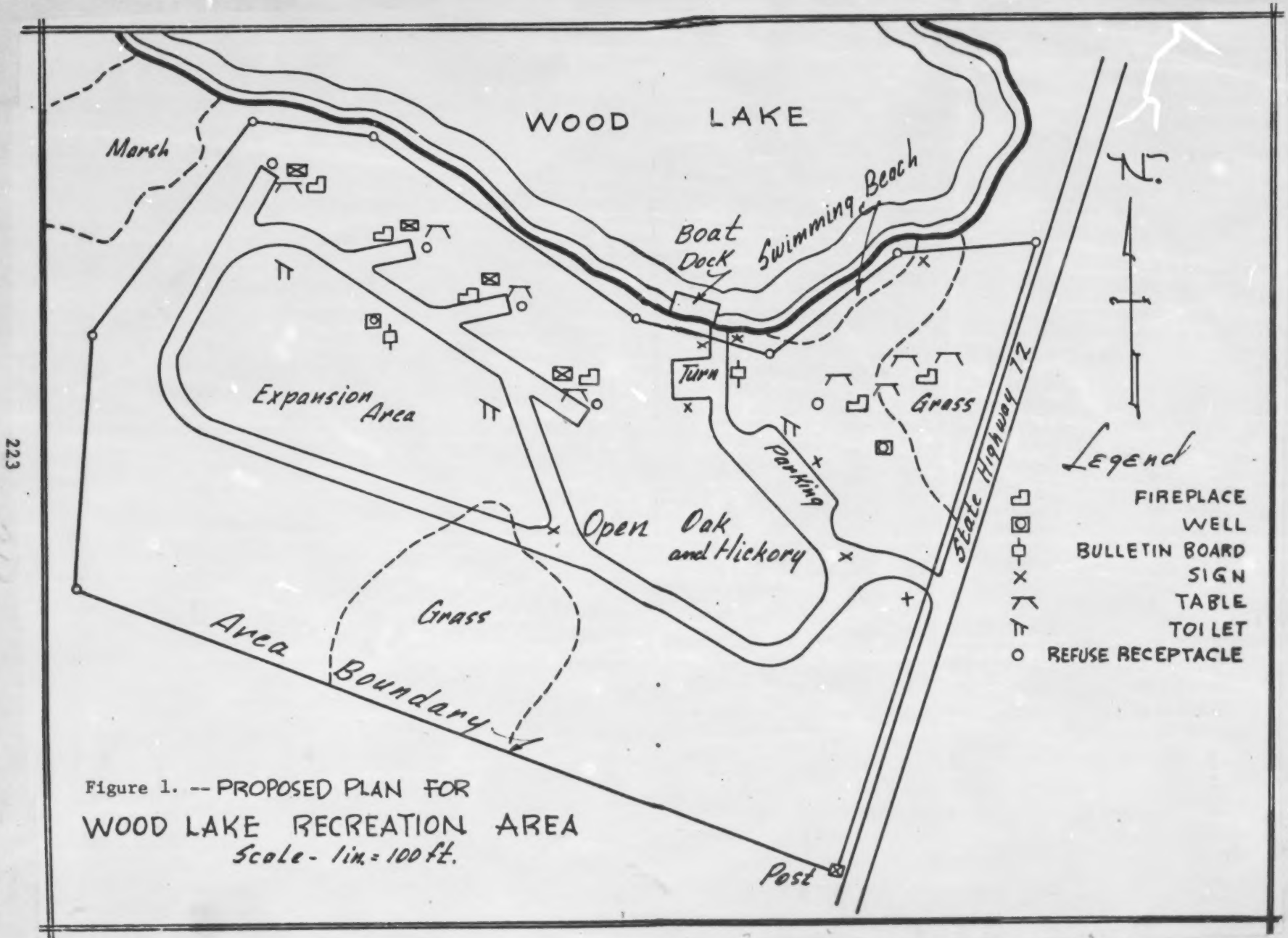


Figure 1. -- PROPOSED PLAN FOR
WOOD LAKE RECREATION AREA
Scale - 1 in. = 100 ft.

PURPOSE: To conduct an investigation of the land use practices employed in your local community.

LEVEL: 10-12

SUBJECT: Social Studies
Science
Math

CONCEPT: Man has developed techniques useful in describing land and its uses.

REFERENCE: Teaching Materials For Environmental Education: Investigating Your Environment. Forest Service, United States Department of Agriculture, July, 1973. SE 016 922.

ACTIVITY: To set the stage for this activity, pick a topic other than a traditional land use subject to illustrate a possible procedure for investigating land use management in your local community.

For example: Transportation

On the chalkboard make three columns as follows:

Column 1 --- What We Want To Find Out
Column 2 --- How To Collect
Column 3 --- How To Record

Solicit class responses and list the items in the appropriate categories.

Here is what a chart might look like after doing it with the class.

Three-Stage, Data-Collecting Chart
Subject: Transportation

Column 1 What we want to find out	Column 2 How to collect	Column 3 How to record
Location of major arterials	Observation	Graphs
Kinds of transportation	Interview people	Statistics
What is needed	Existing studies	Pictures
How much is available	Count number of cases at certain place	Film
Accessibility of terminals	Count types of vehicles	Tape recorders
Land topography		Questionnaire
Is it working		Map
What is being used now		Tables
Growth pattern		
Traffic flow pattern		
Peak traffic needs		
Attitude of people		

Now, ask your class to help you make a list on the chalkboard of major land use categories found in most communities. Your list should include such topics as commercial, residential, recreation, industrial, etc.

Divide your class into study groups covering each of the land use categories listed. Give each student a map of the local community being studied. (The area should be within walking distance of the school.) Also give each student a Three-Stage Data Collecting and Analyzing Chart as follows:

THREE-STAGE DATA COLLECTING AND ANALYZING CHART

Land Use Category_____
(Have each group identify its topic in this space)

Column 1 What we want to find out about our land use category in the area	Column 2 How to collect the information	Column 3 How to record the information

Instruct each study group to fill out the land use category and Column 1 on the chart using the procedure demonstrated through the example of the transportation topic.

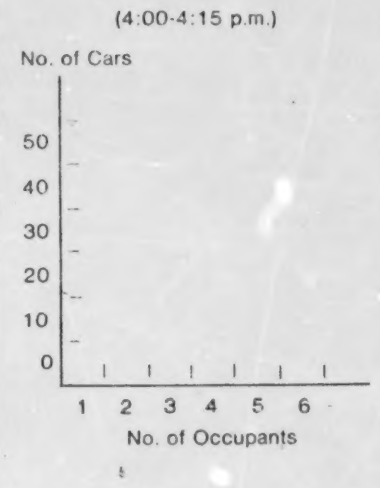
Now ask each study group to identify one or two items from Column 1 of its chart that they want to find out more about from actual observations in the area to be investigated, and construct a data-collecting and recording device to use in collecting and recording their observations. The items selected must deal with data that are observable, collectible, and recordable in the area during the actual field investigation and within the time constraints. Filling out Columns 2 and 3 may help in planning.

Following are sample data-collecting and recording charts to hand up as sample displays.

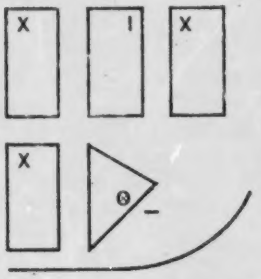
Use of Parks by Age Groups

Age Group	Swim	Walk	Bike	Other
0-6 yrs.				
7-12				
13-21				
21-30				
30-40				
40+				

No. of People in Cars at Intersection



Location of Public Services



Legend:
X fire hydrant
I telephone pole
– restrooms
Θ fire station

When the groups have almost finished making the data-collecting charts, tell them to develop a plan of action to investigate their part of the environment using the data-collecting and recording devices in the allotted field time. (Consider dividing responsibilities for collecting and recording information, who goes where, other tools needed, etc.) Data must be observable, collectible, and recordable.

Before going out to do the investigation, have each group make a short presentation to describe the procedures and to display the recording devices to be used in the investigation. If you have a large class, have groups pair up and critique each other's plans instead of each small group presenting it to the total group.

You are now ready to conduct the investigation.

Tell groups: "You now have ____ hours to do your field work. Be back here at (time). You will then have one hour to prepare a 5-10 minute report about your investigation."

The following list of instructions for the presentation is suggested:

Instructions for the Presentation

1. Describe your task.
2. Report on what you did, how you did it, and what it meant.
3. Describe how you modified your procedure, methods, recording devices, etc.
4. Use more than one person as spokesperson.

5. Use visual displays.
6. Limit report to 5-10 minutes.
7. This is to be a report about the investigation process and not the content or solutions to problems, unless it relates to the process.
8. Do not report on all the minute details.

Each group should give its presentation. Stick to time limits and to the process of the investigation.

A culminating discussion could include the following questions:

How does each land use affect the other land uses of the area?

What problems exist because of certain land uses?

What land use problems in this area are related to regional environmental problems?

What things are being done to the land that are compatible with the:

Characteristics of the land?
Needs of the people?

Which land uses are changing?

What proposed projects could affect land use patterns in this area?

Something to Think About

For each of the land uses you investigate, ask yourself:

Is it in a good location to serve its purpose?
What does it do to the environment?
What kind of an environment does it produce?

PURPOSE: To understand how development of wetlands increases probability of flooding downstream.

LEVEL: 10-12

SUBJECT: Science
Mathematics
Social Studies

CONCEPT: Natural resources are unequally distributed with respect to land areas and political boundaries thus, conflicts emerge between private land use rights and the maintenance of environmental quality for the general public.

REFERENCE: Inland Wetlands, Area Cooperative Educational Services, New Haven, CT, Environmental Education Center. ED 133 219.

ACTIVITY: When wetlands are used for the development of industrial sites or shopping centers, arrangements must be made to handle the run off that occurs during rain storms. Wetlands have the ability to store large quantities of water, on the other hand, impervious surfaces generate large quantities of storm water run off. To illustrate this point, study the following problem.

SCENARIO: You have a parcel of marginal wetland that has 800 feet of frontage on a major highway and is 1,099 feet deep. A development group has made an attractive offer for the pro perty, with the intent of filling the area and building a shopping center on the site.

Neighbors downstream for the site have expressed concern about the flooding of a small stream that runs across the back of the property.

TASK: Calculate the gallons of run off created during a two-inch rainfall if the parcel is covered by an impervious surface (i.e., parking lot and buildings).

PROCEDURE: (To calculate cubic feet of water we must multiply length of site in feet X width of site in feet X depth of water in feet).

1. Calculate the square footage of the area:
   1,009 feet X 800 feet = 871,200 sq. ft.

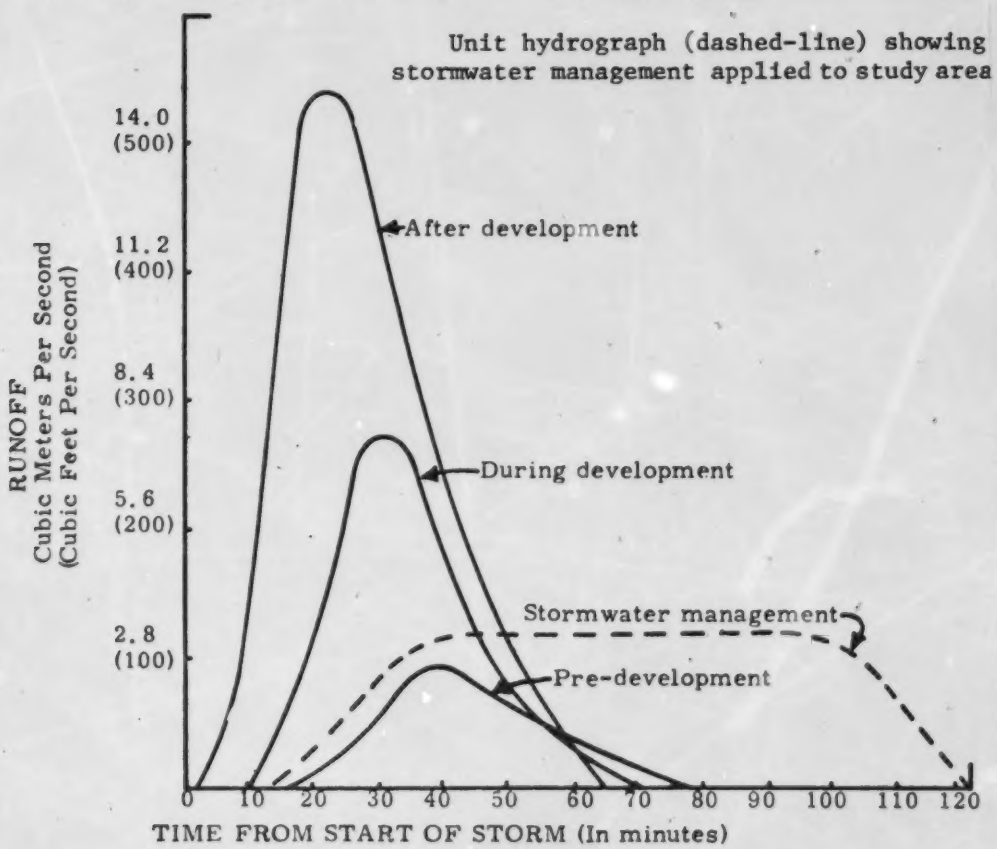
2. Convert 2 inches of rainfall to a fraction of one foot:
   2 inches/12 inches = 1/6 of a foot of rain.

3. To calculate the number of cubic feet of run off from this area, multiply:
   871,200 sq. ft. X 1/6 ft. of rain = 145,200 cu. ft. of run off.

4. One cubic foot of water = 7.48 gallons, so to convert 145,200 cu. ft. to gallons we must multiply by 7.48 gallons per cubic foot. 145,200 cu. ft, x 7.48 gallons per cu. ft = 1,086,096 gallons.

If this quantity of water drains into the stream as direct run runoff, it will raise the height of the stream significantly. Frequently, improper planning for runoff from these kinds of developments have led to serious downstream flooding.

Although the case you have just studied is hypothetical, the problem of increased runoff from development and subsequent pollution does exist. There are many cases of once natural streams becoming severely eroded or flooding because of construction activity in their watersheds. By instituting a sound program of stormwater management, runoff can be retained temporarily and the degree of discharge can be effectively maintained in a range that existed prior to development. The following graph compares the quantity of runoff from a site before, during and after development. The dashed line indicates the way in which potentically damaging runoff can be controlled through a stormwater management program.



Source: Processes, Procedures, and Methods to Control Pollution Resulting from All Construction Activity, EPA Bulletin 430/9-73-007, p. 109.

As you study the graph, there are several important factors which you should observe. In the predevelopment state the peak runoff period occurred about 40 minutes after the start of the storm at a level of about 80 cubic feet per second. During development, runoff peaked at about 30 minutes after the start of the storm of a rate of about 270 cubic feet per second. After development runoff peaked at about 25 minutes after the start of the storm at about 540 cubic feet per second. With a stormwater management program the runoff peak was reached at about 45 minutes at 110 cubic feet per second and stayed at the level until approximately 90 minutes after the start of the storm.

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APPENDICES

Appendix A

Federal Laws Related to Land Use*

1. Homestead Law of 1862

The first Homestead Act marked the era of disposal by opening up the Western public domain for settlement. Under this law, the government offered 160 acres of farm land free to settlers if they would live on it and cultivate the land for five years. Various modifications were afterwards adopted for desert lands that the settler could irrigate, and later for lands irrigated by the government.

Homestead entries, in which title to the land passes to the applicant upon his paying a filing fee and satisfying the requirements of settlement, residence, and cultivation may now be made under provisions of the Homestead Act. However, the land must be classified as suitable for the particular type of homestead before entries will be permitted.

2. Agricultural College Act--Land Grant in Aid of Colleges, 1862 (Amended 1882) Also called Morrill Act.

Land and land script of 30,000 acres each to states to constitute a perpetual fund for support of a College of Agriculture and Mechanical Arts in each state.

3. Yellowstone Park Protective Act of 1872

The first major exception to the policy of complete disposal, implicit in the Homestead Act of 1862, was the reservation of Yellowstone National Park in 1872 with the purpose of preserving it from private exploitation. The park was reserved as a "pleasuring ground," the beginning of the National Park System. Yellowstone is also a Wildlife preserve.

4. General Mining Law of 1872

The General Mining Law opened up the public lands to prospecting the the extracting of hard rock minerals. (See also Mineral Leasing Act.)

5. Desert Land Act of 1877

This Act recognized the aridity of the Western lands by permitting homesteading on lands susceptible to irrigation with local water supplies. supplies.

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*Excerpted from One Hundred Eleven Significant Federal Laws Concerning Natural Reasources and Environment and the Creation of Federal Agencies, School of Natural Resources, The Ohio State University, 1974.

6. Timber and Stone Act of 1878

Under this Act, any citizen could buy 160 acres of nonagricultural land for $2.50 an acre without having to live on it but he did have to swear that he would use the land himself and was not buying it for someone else. This law resulted in a great deal of false swearing and "settlers" selling their land to early lumber companies for timber cutting.

7. Geologic Survey Act of 1879

This Act provided for the "classification of the public lands and the examination of the geologic structure, mineral resources and products of the national domain." This Act also created the U.S. Geologic Survey.

8. Forest Reserve Act of 1891

This Act marked the beginning of the national forest system and the first change in the policy that the public domain was available to the first comer with little regard for the general public. The President was given the power to establish forest reserves from the public domain and legal authority for management of the forest reserves was provided for. The first reserve was the Yellowstone Timberland Reserve. No plan of operation was passed by Congress at this time; the reserves were simply closed areas.

9. Antiquities Act of 1906

Authorized the President to set aside national monuments by proclamation. Their administration is under the National Park Service which annually publishes a report of such areas.

10. Mineral Leasing Act of 1920

With this Act began the system of leasing public lands for mineral and oil extraction, amended several times since but not altered in its basic assumption that the lands involved were going to remain in government hands. The purpose was to stop the sale of mineral lands from the public domain and, instead, grant leases as proposed by the conservationists.

11. Wheeler-Howard Act of 1834

Also called the Indian Reformation Act, established the Bureau of Indian Affairs, for the purpose of administering the federal lands held in trust for the Indian tribes with provisions for the conservation and development of the land resources.

12. Taylor Grazing Act of 1934

The Taylor Grazing Act was passed "to stop injury to public grazing lands by preventing overgrazing and soil deterioration; to provide for orderly use, improvement and development; to stabilize the livestock industry dependent upon the public range." It applied to range lands in the public domain that had not been taken up for homesteads or reserved in national forests.

The Act also gave the Department of the Interior the right to divide the open range into districts for regulated grazing. In addition, the leasing system applied under the Act, to all intents and purposes, ended the period of disposal and settled us in the policy of local management under federal ownership. It also established, for the first time, general land classification authority.

13. Historic Sites Act of 1935 (P.L. 89-249, Amended 1965)

Provided for an Advisory Board of National Parks, Historic Sites, Buildings and Monuments to be formed. A National Survey was established under the Secretary of the Interior for the listing of exceptional historic and archaeological sites the commemorate the history of the United States. In 1960, a Registry of National Historic Landmarks was established through which federal, state, and local groups can call attention to sites of value which should be preserved.

In 1964, a National Registry of Natural History Landmarks was established to complement the Registry of Historic Sites. This gave rise to the preservation of natural areas. Congress chartered the National Trust for Historic Preservation in the United States in 1949 as a quasi-public body to receive donations of sites, buildings, and objects--including gifts of money and securities--significant in American history.

14. Wilderness Act of 1964 (P.L. 88-577)

Approval of this Act sets in motion a plan whereby appropriate units of land in Federal ownership may be brought into a National Wilderness Preservation System. The Act directly incorporates approximately 9,000,000 acres of Federal lands into the Wilderness System and provides machinery whereby 50,000,000 or more additional acres may be so classified. Each land-holding agency reviews lands under its control and makes recommendations to the President concerning suitability for Wilderness classification. Congressional approval of Presidental recommendations is necessary before Wilderness classifications are effective.

15. Land and Water Conservation Fund Act of 1964 (P.L. 88-578)

This Act is intended to provide funds to Federal, state, and local agencies for acquisition of public lands for recreational purposes. Normally, 60% of appropriations under the Act will be allocated to

the states on a matching basis. Not more than 50% of state project costs are to be met from Federal sources. An estimated $90 million are to be available for the program annually. The authorization is for a 25-year period.

The Federal funds for this program are to be reimbursed from several sources. These include:

(1) Admission and user fees for certain Federal areas.

(2) Net proceeds from the sale of Federal surplus real property.

(3) Proceeds from Federal taxes on motorboat fuels.

The formula for allocating funds among states is as follows:

Two-fifths to be allotted among the fifty states equally. The remaining three-fifths to be allotted on the basis of need. In determining need, primary attention is to be given to population, use of present recreation facilities by other states, and the extent of Federal recreation programs within the state. No state may receive more than 7% of the total allotment in any given year.

This fund is to be administered through the Bureau of Outdoor Recreation. Implementation of the program marks a sharp departure from government retrenchment from public land acquisition which has prevailed since World War II.

16. Public Land Law Review Commission Act. Classification and Multiple Use Act. Public Sale Act of the 88th Congress, 1964

Collectively, these acts are intended to fulfill the following five objectives:

(1) To study the varied and complex land laws and recommended actions to insure that public lands serve America's future generations.

(2) To classify public lands for retention or disposition by the Secretary of the Interior. The Multiple-Use Act provides "that the public lands of the United States shall be (a) retained and managed, or (b) disposed of, all in a manner to provide the maximum benefit for the general public."

(3) To meet the needs of local communities and individuals interested in acquiring public lands for local expansion. Presumably, knowing which public lands are available for acquisition will enable communities and individuals adjacent to these lands to plan for orderly growth.

(4) To provide for optimum multiple-use. The Classification and Multiple-Use Act commits the Bureau of Land Management to a

policy of implementing multiple-use on all public lands under its jurisdiction.

(5) To increase the effectiveness of resource management on public lands through the identification of resource management areas and the channeling of management resources to these areas.

The Land Law Review Commission completed its report and ceased to exist on December 31, 1970. Its final report, "One Third of the Nation's Land," is a landmark document.

Appendix B

Federal Agencies Having Responsibilities
With Respect to Land Use Management*

Land Use Changes, Planning and Regulation of Land Development

Department of Agriculture---
  Forest Service (forest lands)
  Agricultural Research Service (agricultural lands)
Department of Housing and Urban Development
Department of the Interior---
  Office of Land Use and Water Planning
  Bureau of Land Management (public lands)
  Bureau of Indian Affairs (Indian lands)
  Bureau of Sport Fisheries and Wildlife (wildlife refuges)
  Bureau of Outdoor Recreation (recreation lands)
  Fish and Wildlife Service
  National Park Service (NPS units)
Department of Transportation
Environmental Protection Agency (pollution effects)
National Aeronautics and Space Administration (remote sensing)
River Basins Commissions (as geographically appropriate).

Public Land Management

Department of Agriculture---
  Forest Service (forests)
Department of Defense
Department of the Interior---
  Bureau of Land Management
  Bureau of Indian Affairs (Indian lands)
  Bureau of Outdoor Recreation (recreation lands)
  Fish and Wildlife Service (wildlife refuges)
  National Park Service (NPS units)
Federal Power Commission (project lands)
General Services Adminstration
National Aeronautics and Space Administration (remote sensing)
Tennessee Valley Authority (project lands)

Protection of Environmentally Critical Areas--Floodplains, Wetlands, Beaches and Dunes, Unstable Soils, Steep Slopes, Aquifer Recharge Areas, etc.

Department of Agriculture---
  Agricultural Stabilization and Conservation Service
  Soil Conservation Service
  Forest Service

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*From The Fifth Annual Report of the Council on Environmental Quality, 1974, U. S. Government Printing Office, pp. 528-531.

Department of Commerce---
  National Oceanic and Atmospheric Administration (coastal areas)
Department of Defense---
  Army Corps of Engineers
Department of Housing and Urban Development (urban and floodplain areas)
Department of the Interior---
  Office of Land Use and Water Planning
  Bureau of Outdoor Recreation
  Bureau of Reclamation
  Bureau of Land Management
  Fish and Wildlife Service
  Geological Survey
Environmental Protection Agency (pollution effects)
National Aeronautics and Space Administration (remote sensing)
River Basins Commissions (as geographically appropriate)
Water Resources Council

Land Use in Coastal Areas

Department of Agriculture---
  Forest Service
  Soil Conservation Service (soil stability, hydrology)
Department of Commerce---
  National Oceanic and Atmospheric Administration (impact on marine life and coastal zone management)
Department of Defense---
  Army Corps of Engineers (beaches, dredge and fill permits, Refuse Act permits)
Department of Housing and Urban Development (urban areas)
Department of the Interior---
  Office of Land Use and Water Planning
  Fish and Wildlife Service
  National Park Service
  Geological Survey
  Bureau of Outdoor Recreation
  Bureau of Land Management (public lands)
Department of Transportation---
  Coast Guard (bridges, navigation)
Environmental Protection Agency (pollution effects)
National Aeronautics and Space Administration (remote sensing)

Redevelopment and Construction in Built-Up Areas

Department of Commerce---
  Economic Development Administration (designated areas)
Department of Housing and Urban Development
Department of the Interior---
  Office of Land Use and Water Planning
Department of Transportation
Environmental Protection Agency
General Services Administration
Office of Economic Opportunity

Density and Congestion Mitigation

Department of Health, Education, and Welfare
Department of Housing and Urban Development
Department of the Interior---
  Office of Land Use and Water Planning
  Bureau of Outdoor Recreation
Department of Transportation
Environmental Protection Agency

Neighborhood Character and Continuity

Department of Health, Education, and Welfare
Department of Housing and Urban Development
National Endowment for the Arts
Office of Economic Opportunity

Impacts on Low-Income Populations

Department of Commerce---
  Economic Development Administration (designated areas)
Department of Health, Education, and Welfare
Department of Housing and Urban Development
Office of Economic Opportunity

Historic, Architectural, and Archeological Preservation

Advisory Council on Historic Preservation
Department of Housing and Urban Development
Department of the Interior---
  National Park Service
  Bureau of Land Management (public lands)
  Bureau of Indian Affairs (Indian lands)
General Services Administration
National Endowment for the Arts

Soil and Plant Conservation and Hydrology

Department of Agriculture---
  Soil Conservation Service
  Agricultural Service
  Forest Service
Department of Commerce---
  National Oceanic and Atmospheric Administration
Department of Defense---
  Army Corps of Engineers (dredging, aquatic plants)
Department of Health, Education, and Welfare
Department of the Interior---
  Bureau of Land Management
  Fish and Wildlife Service
  Geological Survey
  Bureau of Reclamation

Environmental Protection Agency
National Aeronautics and Space Administration (remote sensing)
River Basin Commissions (as geographically appropriate)
Water Resources Council

Outdoor Recreation

Department of Agriculture---
  Forest Service
  Soil Conservation Service
Department of Defense---
  Army Corps of Engineers
Department of Housing and Urban Development (urban areas)
Department of the Interior---
  Bureau of Land Management
  National Park Service
  Bureau of Outdoor Recreation
  Bureau of Indian Affairs
  Fish and Wildlife Service
Environmental Protection Agency
National Aeronautics and Space Administration (remote sensing)
River Basin Commissions (as geographically appropriate)
Water Resources Council

Appendix C

Types of Data for Land Use Studies*

After a student survey has been selected and the objectives are clearly defined, the next step is to apply the available data. In almost all surveys, maps are required for land use studies involving remotely sensed data.

In general, two types of maps are mandatory -- U.S. Geological Survey Maps and aerial photographs. For surveys to be conducted within the boundary of a city, a current "gas station" city map will add information. For large surveys, a current "gas station" state map may be helpful. Sometimes special survey maps, such as Corps of Engineers plans or Bureau of Reclamation plans, are necessary.

U.S. Geological Survey maps are available from any regional federal center or from some sporting goods stores. The address of the nearest federal center can be obtained from the telephone directory listing entitled "United States Government." More details on what to order and what to expect are given below.

Other types of data include direct observations of features recorded in photographs or in notebooks; measurements made in the field by means of surveyors tools such as measuring tapes, levels, and transits; or data obtained by "remote sensors."

In this publication, the term "remote sensor" is applied to systems that record information from above the ground by instruments in aircraft or in spacecraft, i.e., the camera, an altimeter, or a spectrometer. These data are available as photographic images or as electronic information on magnetic tape.

Three general methods are or have been used to obtain remotely sensed data gathered from above the surface of the Earth--by aircraft, by earth resources satellites, and by NASA's Skylab spacecraft. The Space Shuttle, scheduled for launch in the late 1970's will also obtain remote sensor data.

Aerial photographs of all areas of the United States are available in several different forms. Aerial photographs have been taken from altitudes of 12,000 to 25,000 feet of areas from about 4.5 miles square to 9 miles square respectively. The classical application of data obtained by aircraft is for map-making. The information is generally obtained as photographs that are used to update existing maps, to make new maps of unmapped areas, and to provide accurate contour information through analysis of stereo photographs (see Why Survey From Space, NASA Facts NF-57/1-75).

Aerial photographs are available from the U.S. Geological Survey Photo-Mapping Service, the U.S. Department of Agriculture, NASA and from the National Oceanic and Atmospheric Administration.

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*Reprinted with slight modification from: Jefferson County, Colorado Public Schools, What's the Use of Land?, pp. 31-4.

Remote sensor information is provided by ERTS-1, the first Earth Resources Technology Satellite, that was launched by NASA in July 1972 and is still providing information to the ground.

ERTS-1 orbits the Earth at an altitude of about 920 kilometers (570 miles) in an orbit that passes close to the North and South Poles. This was the first of a series of satellites with the primary purpose of demonstrating the usefulness of remote sensor data in the study of surface conditions of the Earth. This unmanned satellite completes one complete cycle of scanning the Earth's surface every 18 days. Information obtained by instruments scanning a 185-kilometer (115-mile) square area is transmitted to the ground electronically and converted to photographic images in four different wavebands: two in the visible light frequency and two in infrared.

When the second satellite in this series was launched in January 1975, the program name was changed to LANDSAT. ERTS-1 became LANDSAT 1 and the new satellite is LANDSAT 2, which has design life of two years. A third LANDSAT launch is planned for 1977.

Remotely sensed data were obtained from Skylab in three manned missions from May 1973, to February 1974. Earth resource data were obtained as photographs and as electronically produced images. Some areas were photographed at the same time by two camera systems. One was a combination of cameras that produced photographs in six different wavebands--three in the visible and three in infrared--all obtained at exactly the same time. The other was a high resolution camera that obtained photographs in either the visible or infrared wavelengths. Electronic data were obtained for altimeter applications, for determining surface brightness temperature, and for recording the reflected radiance of the Earth's surface in many different wavebands. Observing Earth From Skylab (NF-56/1-75) contains more information on these instruments and the data they obtained.

Where to Obtain Remotely Sensed Data

The following paragraphs give detailed information on the types of data available from different sources and show how to obtain it.

1. EARTH RESOURCES OBSERVATION SYSTEM (EROS)

Earth resource data can be obtained by writing to the EROS Data Center, a division of the Department of the Interior. The address is:

EROS
Data Management Center
Sioux Falls, South Dakota 57190

The EROS Data Center will assist in locating imagery and photography to suit the particular needs of the user. The center's computerized storage and retrieval system is based on geographical coordinates (latitude and longitude), the date and time of day the photographs were obtained, and the scale of the photographs.

The requestor may provide the center with the latitude and longitude of the point of interest, or may define an area by giving latitude and longitude of a maximum of eight perimeter points. On receipt of a request the center staff will locate the area of interest and will prepare a listing of photographs from which the requestor can make the final selection.

EROS stocks Skylab photographs in your study, it is possible to help EROS speed up your order by quoting the specific photograph numbers of the scene you need. You can write to the following address for help.

Lyndon B. Johnson Space Center
Research Data Facility
Mail Code TF-8
Houston, Texas

Include the names of prominent features in the area. City names, rivers, and mountains should be included as well as latitude and longitude. Research Data Facility personnel will check through their catalogs and provide you with photograph identification numbers that you can send to EROS to obtain the copies you need.

At the time of writing the prices of EROS photographs are:

ERTS/LANDSAT

Paper Prints	Scale	Black & White	Color	Area of Photograph
70 mm square	1:3,369,000	$1.25	--	149 mi sq
9x9 in.	1:1,100,000	$1.25	$ 7.00	140 mi sq
18x18 in.	1: 500,000	$3.50	$15.00	140 mi sq
36x36 in.	1: 250,000	$9.00	$25.00	140 mi sq
Film positives are available at two to three times the above costs.				

SKYLAB

Image Size	Print Price	Black & White Transparency	Scale	Area of Photograph
2.2 in. sq		$2.00	1:2,850,000	100 mi sq
6.4 in. sq	$ 2.00	--	1:1,000,000	100 mi sq
12.8 in. sq	$ 5.00	--	1: 250,000	100 mi sq
25.6 in. sq	$12.00	--	1: 250,000	100 mi sq

25E

Color reproductions cost about three times as much as black and white. For more details write to EROS at Sioux Falls, South Dakota.

Another outlet for EROS services is located in Bay St. Louis, Mississippi. At the National Space Technology Laboratories, anyone can obtain a wide variety of Earth resources information and order photographs by writing to the following address:

National Space Technology Laboratories
Bay St. Louis, Mississippi 37520

2. U.S. GEOLOGICAL SURVEY

U.S. Geological Survey (USGS) maps are available from any regional Federal Center and from certain commercial stores such as sporting goods stores. The nearest address should be listed in the telephone book under "United States Government--U.S. Geological Survey."

The most common USGS maps are of an area 7 1/2 minutes square or 15 minutes square--that is, 7 1/2 or 15 minutes of latitude and 7 1/2 or 15 minutes of longitude. The scales of these maps are 1:24,000 and 1:62,500 respectively. Both are sold for 75 cents each at the time of writing.

Other maps are available. Check with the USGS office for more details.

3. SKYLAB EARTH RESOURCES DATA CATALOG

The Skylab Earth Resources Data Catalog (GPO-3300-00586), prepared by NASA, provides a complete index of Skylab earth resources photographs and other data, plus direction on how copies can be obtained. It also provides a discipline-by-discipline review of possible uses of the Skylab photographs and data with appropriate illustrations. It is intended as a basic reference work, or tool, for farmers, scientists, engineers, students, mineral developers, or anybody else who has a specific need to obtain, interpret, and use remotely sensed information.

The catalog is divided into six major subject areas:

1) Land resource management--This term encompasses familiar issues of public policy related to such matters as population growth, economic development, land use, depletion of natural resources, urban planning, transportation, and environmental impact. To meet dynamic mapping and monitoring requirements, satellite data are currently being used by seven states (Alabama, Alaska, Arizona, California, Iowa, New York, and Ohio) and three interstate planning agencies in the Midwest, New England, and the Middle Atlantic regions.

2) Water resources--Skylab and other space data are well suited to: exploring for new sources of water; making inventory of existing water supplies in lakes, reservoirs, rivers, and snowfields; and assessing water quality in terms of turbidity, sedimentation, and temperature (by thermal scanning). Depths of shallow bodies of water can also be

estimated with some precision. Space observation can establish the area of a watershed and facilitate study of stream channels in relation to an entire drainage system, runoff patterns, and possibility of flooding. River ice, crucial to transportation and flood prediction in some parts of the country, can be watched. Coastal lands, estuaries, and wet-lands--with their ecological as well as economic significance--can be delineated for analysis.

3) Marine resources--From seeking to establish patterns of movement of schools of fish to measuring degrees of roughness of the open sea, Skylab data have increased our knowledge of the world's oceans and helped point to operational marine satellite systems. Better weather forecasts and charts of ocean currents and ice conditions are expected as direct results. To measure oceanic roughness or sea state, a matter of vast practical importance to shippers, Skylab successfully tested a combination of instruments (radar scatterometer, microwave radiometer, and altimeter) that provided oceanwide readings starting at small-scale roughness. Channels, shallow areas, river discharges of sediment, and other features of waterways often show up better from space than by any other means.

4) Geology and mineral resources--Obviously, space photography and data acquisition are made to order for geologic investigators in every facet of their work from theory to actual mineral prospecting. In exploring for minerals and hydrocarbons, the cost per mile of space coverage is lower than for any other method. Major mineral exploration organizations have been working with Skylab and LANDSAT 1 data while incorporating use of space data in plans for the future. Space sensing, it is pointed out, should be seen as one basic step in the overall prospecting program. After reviewing satellite data, mineral exploration target maps can be constructed with a rating system to indicate the relative likelihood of deposits in each target area. Decisions on further exploration--such as aircraft remote sensing, seismic profiling, geochemical analysis, or field testing--can then be made with a far greater chance of success.

5) Agriculture, forest, and range resources--Survey of the world's rice crops and battling Black Hills beetles are only the beginning in these fields. Potential space applications are enormous: crop and timber inventories, yield estimates, comparative analyses of crops, detection of diseases or insect infestations of vegetation, reconnaissance for potential logging operations, location and mapping of forest and range fire damage, determination of animal-sustaining capacity of range forage, and multiple use planning for forest and range lands. Skylab and LANDSAT 1 data and experience have made major contributions, and now are pointing the way to further hardware and techniques.

6) Environment--In a broad sense, all Skylab effort deals with man's environment. The data also proved particularly useful regarding specific environmental problems. Sources of water and air pollution often can be located and the spread of contaminants traced for long distances

in a single photograph. Looking ahead, Skylab demonstrates the advantages of an Earth resources package, including both high resolution cameras and electronic sensors, complementing each other's capabilities to perform a four-part environmental mission in space: detection, determination of source and extent, direction of aircraft surveys and extent, direction of aircraft surveys and ground measurements, and monitoring changes.

The Skylab Earth Resources Data Catalog is obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (Price $12.50). The book number is GPO-3300-00586.

4) AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE (ASCS)

Three different types of Earth resource data are available from the U.S. Department of Agriculture ASCS--ERTS/LANDSAT data, Skylab data, and aerial photography.

The ERTS/LANDSAT and Skylab data can be ordered from ASCS in a similar manner and similar cost as from EROS. The aerial photographs can be ordered by state and county, and by symbol, roll, and exposure number as listed in the state ASCS office. These photographs can be ordered from either the Eastern or Western ASCS offices. The addresses are listed below:

Eastern Aerial Photography Laboratory
ASCS - USDA
45 South French Broad Avenue
Ashville, North Carolina 28801

Western Aerial Photography Laboratory
ASCS - USDA
2505 Parley's Way
Salt Lake City, Utah 84109

If the state ASCS office is not convenient, either laboratory above will assist in identifying the numbers of the desired photographs. Typical costs of the photographs are:

Size of Prints	Approximate Scale	Cost of Paper Prints	Cost of Film Positives
9½x9½ in.	1:20,000 (1 in. = 1667 ft)	$ 2.00	$3.00
12x12 in.	1:15,840 (1 in. = 1320 ft)	$ 4.00	$4.50
17x17 in.	1:12,000 (1 in. = 1000 ft)	$ 5.00	$5.50
24x24 in.	1:7920 (1 in. = 660 ft)	$ 6.00	$7.50
38x38 in.	1:4800 (1 in. = 400 ft)	$12.00	$6.00

5. FOREST SERVICE

The Forest Service, a division of the U.S. Department of Agriculture can provide aerial photographs of numerous locations in the United States. Black and white, or color prints can be obtained of scenes photographed in visible light or infrared wavelengths. The prints are in a range of scales, predominantly 1:15,840 and 1:80,000.

Requests should be sent to the Regional Forester in your area. The address should be listed in the telephone book under "United States Government--U.S. Department of Agriculture." Alternatively you can write to: The Forest Service, U.S. Department of Agriculture, Washington, D.C. 20250.

Appendix D

LAND CAPABILITY CLASSIFICATION*

LAND SUITED TO CULTIVATION AND OTHER USES

Class I--Soils in class I have few limitations that restrict their use.

Soils in this class are suited to a wide range of plants and may be used safely for cultivated crops, pasture, range, woodland, and wildlife. The soils are nearly level[1] and erosion hazard (wind or water) is low. They are deep, generally well drained, and easily worked. They hold water well and are either fairly well supplied with plant nutrients or highly responsive to inputs of fertilizer.

The soils in class I are not subject to damaging overflow. They are productive and suited to intensive cropping. The local climate must be favorable for growing many of the common field crops.

In irrigated areas, soils may be placed in class I if the limitation of the arid climate has been removed by relatively permanent irrigation works. Such irrigated soils (or soils potentially useful under irrigation) are nearly level, have deep rooting zones, have favorable permeability and water-holding capacity, and are easily maintained in good tilth. Some of the soils may require initial conditioning including leveling to the seasonal water table. Where limitations due to salts, water table, overflow, or erosion are likely to recur, the soils are regarded as subject to permanent natural limitations and are not included in class I.

Soils that are wet and have slowly permeable subsoils are not placed in class I. Some kinds of soil in class I may be drained as an improvement measure for increased production and ease of operation.

Soils in class I that are used for crops need ordinary management practices to maintain productivity--both soil fertility and soil structure. Such practices may include the use of one or more of the following: Fertilizers and lime, cover and green-manure crops, conservation of crop residues and animal manures, and sequences of adapted crops.

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[1]Some rapidly permeable soils in class I may have gentle slopes.

*From A. A. Klingebiel and P. H. Montgomery, Land-Capability Classification. U. S. Department of Agriculture, Soil Conservation Service, Agriculture Handbook No. 210, 1976, pp. 6-10.

Class II--Soils in class II have some limitations that reduce the choice of plants or require moderate conservation practices.

Soils in class II require careful soil management, including conservation practices, to prevent deterioration or to improve air and water relations when the soils are cultivated. The limitations are few and the practices are easy to apply. The soils may be used for cultivated crops, pasture, range, woodland, or wildlife food and cover.

Limitations of soils in class II may include singly or in combination the effects of (1) gentle slopes, (2) moderate susceptibility to wind or water erosion or moderate adverse effects of past erosion, (3) less than ideal soil depth, (4) somewhat unfavorable soil structure and workability, (5) slight to moderate salinity or sodium easily corrected but likely to recur, (6) occasional damaging overflow, (7) wetness correctable by drainage but existing permanently as a moderate limitation, and (8) slight climatic limitations on soil use and management.

The soils in this class provide the farm operator less latitude in the choice of either crops or management practices than soils in class I. They may also require special soil-conserving cropping systems, soil conservation practices, water-control devices, or tilage methods when used for cultivated crops. For example, deep soils of this class with gentle slopes subject to moderate erosion when cultivated may need one of the following practices or some combination of two or more: Terracing, stripcropping, contour tillage, crop rotations that include grasses and legumes, vegetated water-disposal areas, cover or green-manure crops, stubble mulching, fertilizers, manure, and lime. The exact combinations of practices vary from place to place, depending on the characteristics of the soil, the local climate, and the farming system.

Class III--Soils in class III have severe limitations that reduce the choice of plants or require special conservation practices, or both.

Soils in class III have more restrictions than those in class II and when used for cultivated crops the conservation practices are usually more difficult to apply and to maintain. They may be used for cultivated crops, pasture, woodland, range, or wildlife food and cover.

Limitations of soils in class III restrict the amount of clean cultivation; timing of planting, tillage, and harvesting; choice of crops; or some combination of these limitations. The limitations may result from the effects of one or more of the following: (1) Moderately steep slopes; (2) high susceptibility to water or wind erosion or severe adverse effects of past erosion; (3) frequent overflow accompanied by some crop damage; (4) very slow permeability of the subsoil; (5) wetness or some continuing waterlogging after drainage; (6) shallow depths to bedrock, hardpan, fragipan, or claypan that limit the rooting zone and the water storage; (7) low moisture-holding capacity; (8) low fertility not easily corrected; (9) moderate salinity or sodium; or (10) moderate climatic limitations.

When cultivated, many of the wet, slowly permeable but nearly level soils in class III require drainage and a cropping system that maintains or improves the structure and tilth of the soil. To prevent puddling and to improve permeability it is commonly necessary to supply organic material to such soils and to avoid working them when they are wet. In some irrigated areas, part of the soils in class III have limited use because of high water table, slow permeability, and the hazard of salt or sodic accumulation. Each distinctive kind of soil in class III has one or more alternative combinations of use and practices required for safe use, but the number of practical alternatives for average farmers is less than that for soils in class II.

Class IV--Soils in class IV have very severe limitations that restrict the choice of plants, require very careful management of both.

The restrictions in use for soils in class IV are greater than those in class III and the choice of plants is more limited. When these soils are cultivated, more careful management is required and conservation practices are more difficult to apply and maintain. Soils in class IV may be used for crops, pasture, woodland, range, or wildlife food and cover.

Soils in class IV may be well suited to only two or three of the common crops or the harvest produced may be low in relation to inputs over a long period of time. Use for cultivated crops is limited as a result of the effects of one or more permanent features such as (1) steep slopes, (2) severe susceptibility to water or wind erosion, (3) severe effects of past erosion, (4) shallow soils, (5) low moisture-holding capacity, (6) frequent overflows accompanied by severe crop damage, (7) excessive wetness with continuing hazard of waterlogging after drainage, (8) severe salinity or sodium, or (9) moderately adverse climate.

Many sloping soils in class IV in humid areas are suited to occasional but not regular cultivation. Some of the poorly drained, nearly level soils placed in class IV are not subject to erosion but are poorly suited to intertilled crops because of the time required for the soil to dry out in the spring and because of low productivity for cultivated crops. Some soils in class IV are well suited to one or more of the special crops, such as fruits and ornamental trees and shrubs, but this suitability itself is not sufficient to place a soil in class IV.

In subhumid and semiarid areas, soils in class IV may produce good yields of adapted cultivated crops during years of above average rainfall; low yields during years of average rainfall; and failures during years of below average rainfall. During the low rainfall years the soil must be protected even though there can be little or no expectancy of a marketable crop. Special treatments and practices to prevent soil blowing, conserve moisture, and maintain soil productivity are required. Sometimes crops must be planted or emergency tillage used for the primary purpose of maintaining the soil during years of low rainfall. These treatments must be applied more frequently or more intensively than on soils in class III.

LAND LIMITED IN USE--GENERALLY NOT SUITED TO CULTIVATION*

Class V--Soils in class V have little or no erosion hazard but have other limitations impractical to remove that limit their use largely to pasture, range, woodland, or wildlife food and cover.

Soils in class V have limitations that restrict the kind of plants that can be grown and that prevent normal tillage of cultivated crops. They are nearly level but some are wet, are frequently overflowed by streams are stony, have climatic limitations, or have some combination of these limitations. Examples of class V are (1) soils of the bottom lands subject to frequent overflow that prevents the normal production of cultivated crops, (2) nearly level soils with a growing season that prevents the normal production of cultivated crops, (3) level or nearly level stony or rocky soils, and (4) ponded areas where drainage for cultivated crops is not feasible but where soils are suitable for grasses or trees. Because of these limitations cultivation of the common crops is not feasible but pastures can be improved and benefits from proper management can be expected.

Class VI--Soils in class VI have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.

Physical conditions of soils placed in class VI are such that it is practical to apply range or pasture improvements, if needed, such as seeding, liming, fertilizing, and water control with contour furrows, drainage ditches, diversions, or water spreaders. Soils in class VI have continuing limitations that cannot be corrected, such as (1) steep slope, (2) severe erosion hazard, (3) effects of past erosion, (4) stoniness, (5) shallow rooting zone, (6) excessive wetness or overflow, (7) low moisture capacity, (8) salinity or sodium, or (9) severe climate. Because of one or more of these limitations these soils are not generally suited to cultivated crops. But they may be used for pasture, range, woodland, or wildlife cover or for some combination of these.

Some soils in class VI can be safely used for the common crops provided unusually intensive management is used. Some of the soils in this class are also adapted to special crops such as sodded orchards, blueberries, or the like, requiring soil conditions unlike those demanded by the common crops. Depending upon soil features and local climate the soils may be well or poorly suited to woodlands.

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*Certain soils grouped into classes V, VI, VII, and VIII may be made fit for use for crops with major earthmoving or other costly reclamation.

Class VII--Soils in class VII have very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodland, or wildlife.

Physical conditions of soils in class VII are such that it is impractical to apply such pasture or range improvements as seeding, liming, fertilizing, and water control with contour furrows, ditches, diversions, or water spreaders. Soil restrictions are more severe than those in class VI because of one or more continuing limitations that cannot be corrected, such as (1) very steep slopes, (2) erosion, (3) shallow soil, (4) stones, (5) wet soil, (6) salts or sodium, (7) unfavorable climate, or (8) other limitations that make them unsuited to common cultivated crops. They can be used safely for grazing or woodland or wildlife food and cover or for some combination of these under proper management.

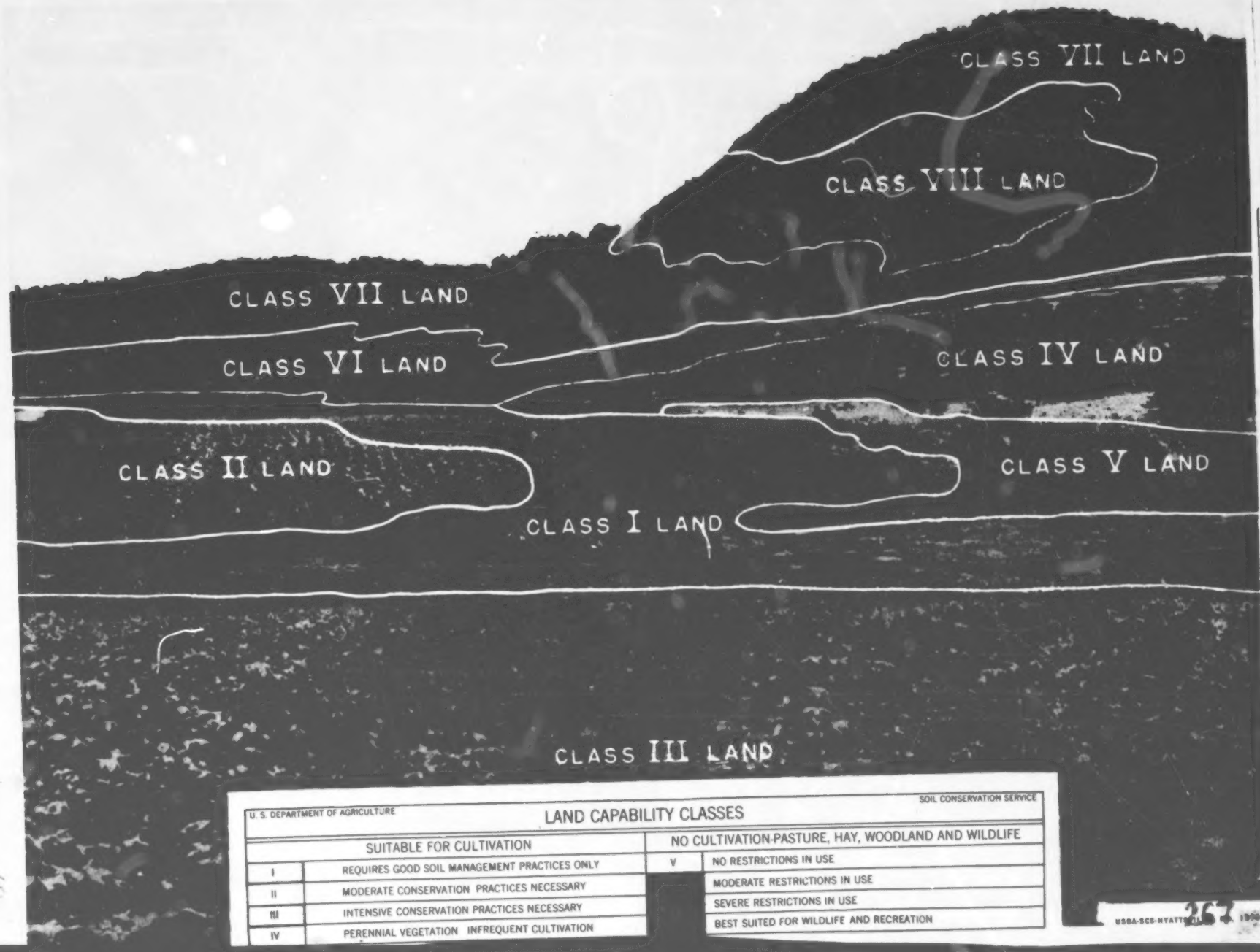
Depending upon the soil characteristics and local climate, soils in this class may be well or poorly suited to woodland. They are not suited to any of the common cultivated crops; in unusual instances, some soils in this class may be used for special crops under unusual management practices. Some areas of class VII may need seeding or planting to protect the soil and to prevent damage to adjoining areas.

Class VIII--Soils and landforms in Class VIII have limitations which preclude their use for commercial plant production and restrict their use to recreation, wildlife, or water supply or to esthetic purposes.

Soils and landforms in class VIII cannot be expected to return significant on-site benefits from management for crops, grasses, or trees, although benefits from wildlife use, watershed protection, or recreation may be possible.

Limitations that cannot be corrected may result from the effects of one or more of the following: (1) Erosion or erosion hazard, (2) severe climate, (3) wet soil, (4) stones, (5) low moisture capacity, and (6) salinity or sodium.

Badlands, rock outcrop, sandy beaches, river wash, mine tailings, and other nearly barren lands are included in class VIII. It may be necessary to give protection and management for plant growth to soils and landforms in class VIII in order to protect other more valuable soils, to control water, or for wildlife or esthetic reasons.



U. S. DEPARTMENT OF AGRICULTURE — SOIL CONSERVATION SERVICE

LAND CAPABILITY CLASSES

SUITABLE FOR CULTIVATION		NO CULTIVATION-PASTURE, HAY, WOODLAND AND WILDLIFE	
I	REQUIRES GOOD SOIL MANAGEMENT PRACTICES ONLY	V	NO RESTRICTIONS IN USE
II	MODERATE CONSERVATION PRACTICES NECESSARY		MODERATE RESTRICTIONS IN USE
III	INTENSIVE CONSERVATION PRACTICES NECESSARY		SEVERE RESTRICTIONS IN USE
IV	PERENNIAL VEGETATION INFREQUENT CULTIVATION		BEST SUITED FOR WILDLIFE AND RECREATION

USDA-SCS-NYATTC-[illegible]-1-1950

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Information Reference Center for Science, Mathematics, and Environmental Education
1200 Chambers Road, 310
Columbus, Ohio 43212

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